THE MARINE REVIEW

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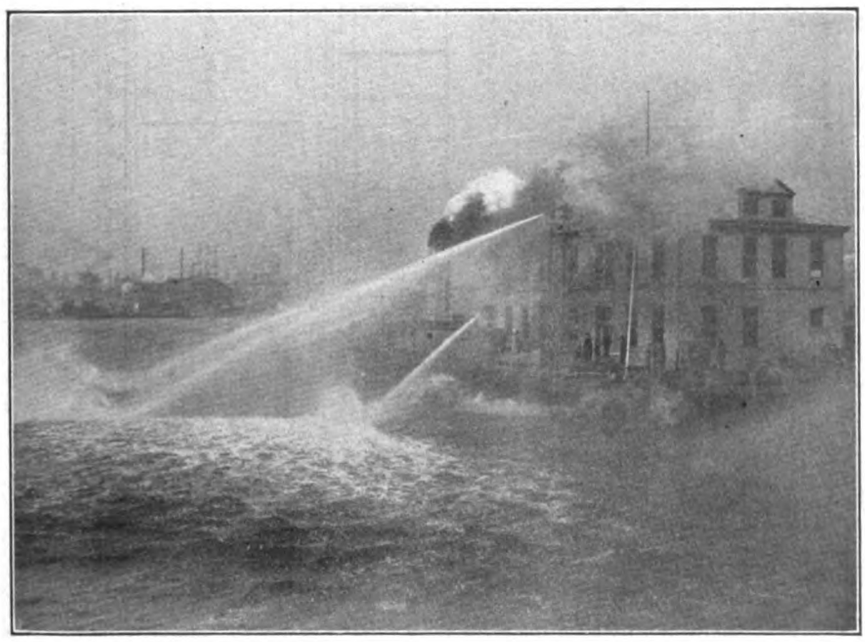
THE BALTIMORE FIREBOAT DELUGE

THE fireboat Deluge was recently completed by the Skinner Ship Building & Dry Dock Co., of Baltimore, for the fire department of the City of Baltimore, from the designs of W. I. Babcock, engineer and naval architect, 17 State street, New York. The hull



FIREBOAT DELUGE IN ACTION, LOOKING FORWARD.

is of steel throughout, 120 ft. over all, 109 ft. 6 in. between perpendiculars, 28 ft. molded beam and 15 ft. molded depth, with five bulkheads, three of which are watertight. There is a single deck from end to end, with lower decks forward and aft of machinery space only, all of which are of steel complete without wood covering. The between decks forward is used for a hose room, with racks capable of holding 2,000 ft. of hose, with a hatch through the deck forward of the pilot house fitted with rollers all around for passing the hose on deck. The hold under the hose room, and the after peak, form fresh water tanks for make-up feed. The lower deck aft contains only the electric lighting set and lockers for the crew. There is a steel deck house over the boiler room and coal bunker, the forward end of which is fitted up as a nozzle room with stairway to the steel pilot house above. The after end of this deck house is extended over the central hose turret to make a platform for working a large monitor nozzle. A life raft is stowed on top of the deck house. The steering engine in the pilot house is of the Queen City hydraulic type.

There are no living accommodations on the boat, the quarters for the crew being in the fire house on the pier, as usual.

In the engine room are placed two pumping sets with a guaranteed capacity of 4,500 gallons each at 150 pounds pressure. Each set consists of a General Electric Curtis steam turbine and a Worthington centrifugal pump, all on one bed plate and one horizontal shaft. Each turbine has its own surface condenser, circulating pump and wet and dry vacuum pumps, and all pumps are cross connected so that either or both condensers may be used with either set of pumps. The main fire pumps are so arranged that they may be worked in series, delivering then 4,500 gallons per minute at 300 pounds pressure. The discharge pipes from the pumps are connected together and lead to a turret immediately over them, to another turret placed at the bow, with a branch to a monitor at the top of the pilot house, and to a monitor at the top of a steel lattice tower on the after deck, which is about 35 ft. above the water line.

The engine room also contains the propelling engine, which is of the

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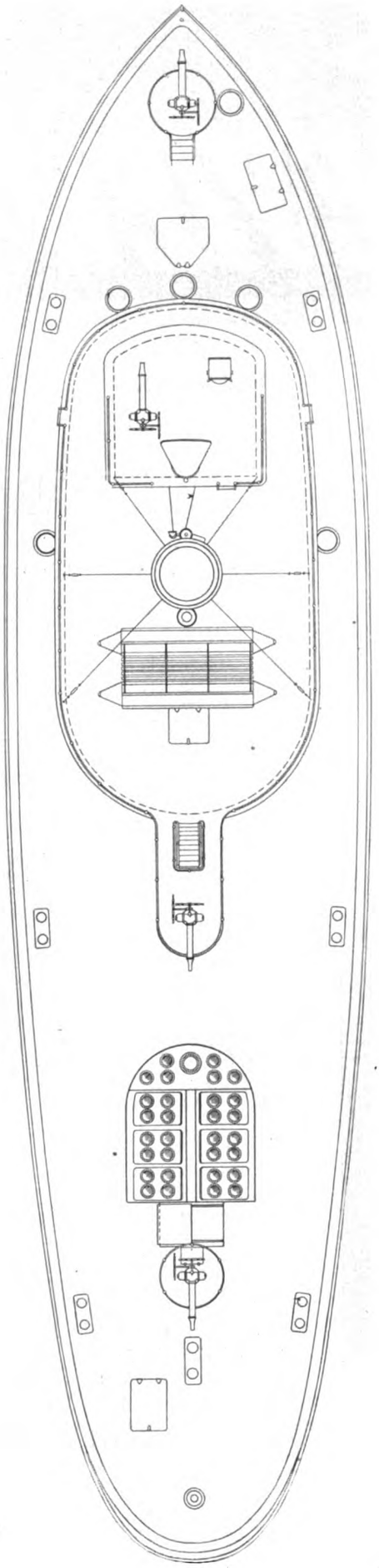
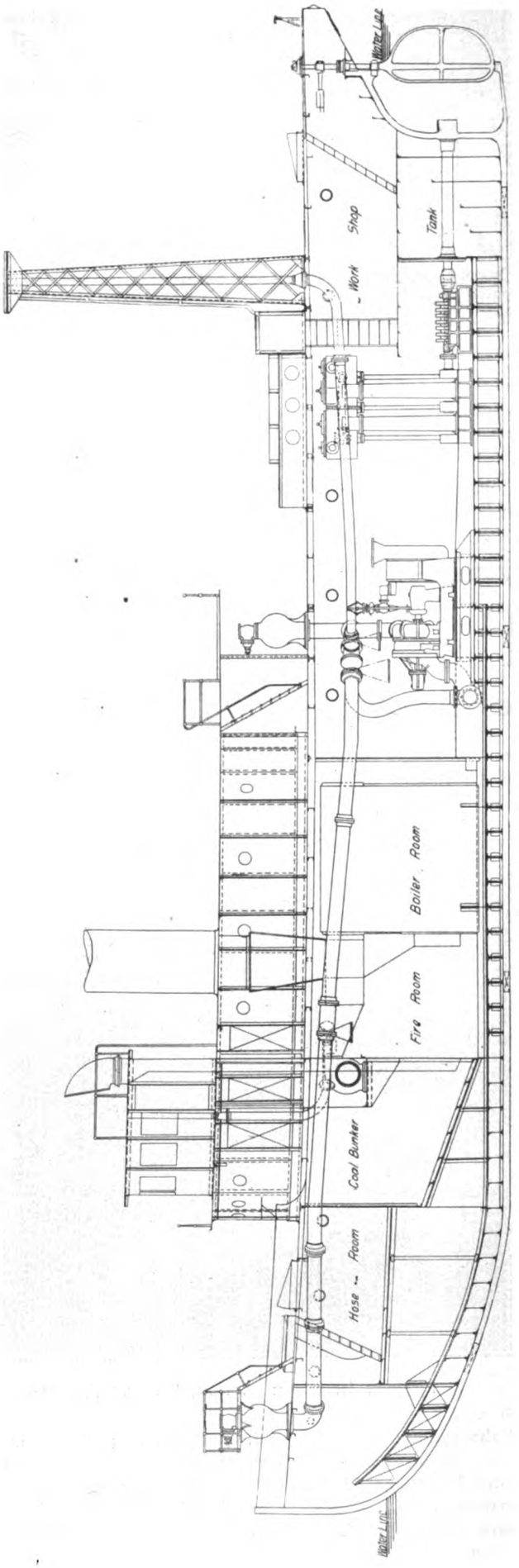


DECK PLAN OF FIREBOAT DELUGE.



INBOARD PROFILE OF FIREBOAT DELUGE.

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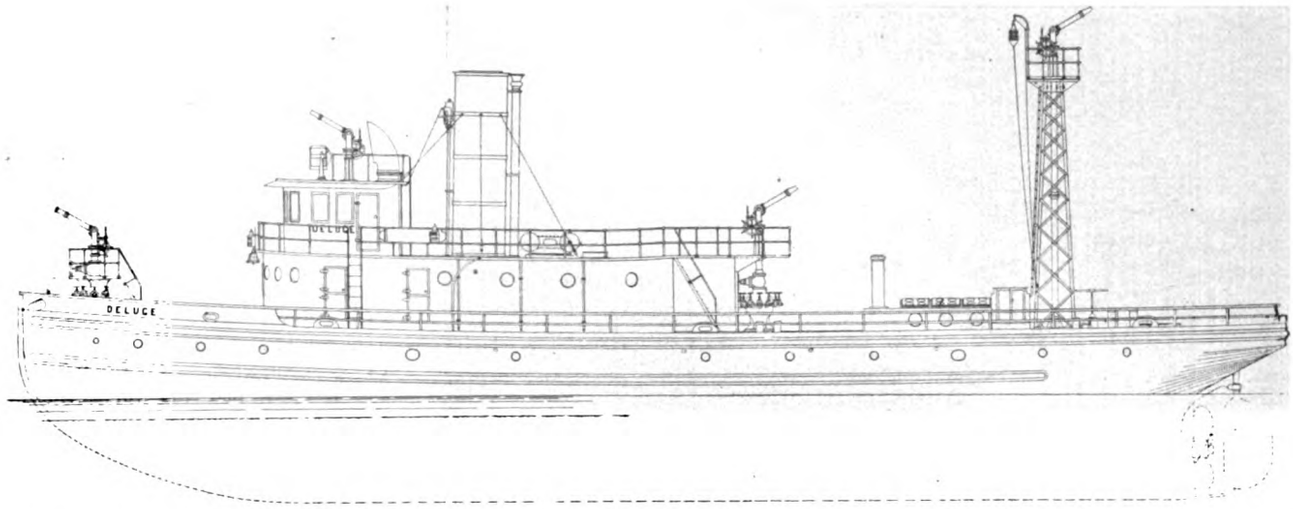
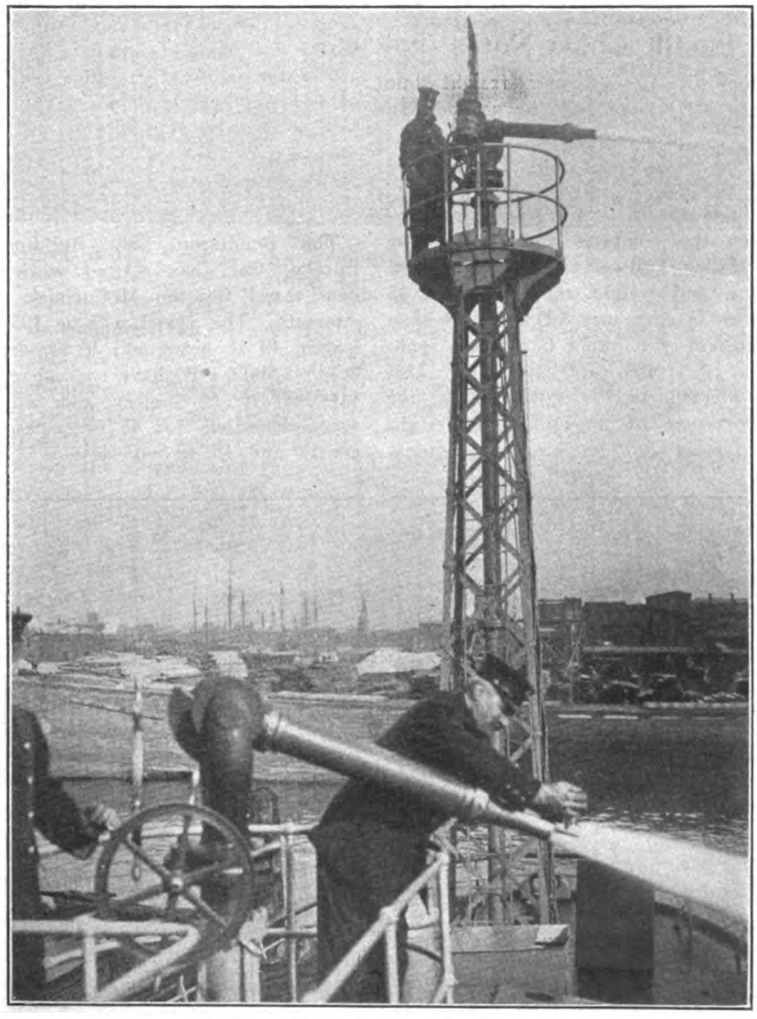


vertical, inverted, double-cylinder, non-condensing type, with two cranks and having cylinders 20-in. diameter by 20-inch stroke, and is of very substantial construction. This engine drives a single four-bladed propeller 8 ft. diameter, which is of cast steel.

Steam is supplied by two Scotch boilers 12 ft. 6 in. in diameter by 11 ft. 6 in. long, allowed 170 lb. pressure, placed abreast of each other next forward of the engine room, with fire room on forward side and coal bunker next to fire room. Each boiler contains two Morrison furnaces 48 in. in diameter, fitted with separate combustion chambers. The tubes are 2¼ in. diameter. The boilers are fitted with a system of heated forced draft, the blower being placed in a recess in the bulkhead at the forward side of the fire room, and is of the Sturtevant type. The vertical feed pumps are of the Blake type and the feed water heater was supplied by the Griscom-Spencer Co., of New York.



OPERATING MONITORS OF DELUGE FROM BRIDGE AND TOWER.

The center turret is fitted with 12 3-in. connections for hose and the bow turret has two 3-in. and six 3½-in. connections. There are four monitors as shown by the plans, one over each turret, one on top of pilot house and one on the tower aft. These monitors were furnished by Andrew J. Morse & Son of Boston.

The electric light plant has a 10-K. W. General Electric standard marine set, with about 80 lamps distributed about the vessel, and an 18-inch search light on top of pilot house.

The engine room skylight and companionway is of steel complete with a large number of circular lights, which, as well as the pilot house windows, are of wire glass.

The pump test took place on March 2 last, at the fireboat station in Baltimore harbor, when four 3-in. streams were thrown through the monitors continuously for six hours. The average water pumped during that time was 10,624 gallons per minute at a pressure of 145.5 lb. The photographs reproduced herewith were taken during this test.

On March 4 the boat went on a trial trip down the bay, during which, with 170 lb. of steam and the wheel making over 150 revolutions, the engine developed 1,100 H. P. and a speed of 15 miles an hour was reached. Everything was so satisfactory that the Board of Fire Commissioners formally accepted the boat at the conclusion of the trial trip and she went on her station and into regular service at 8 o'clock the same night.

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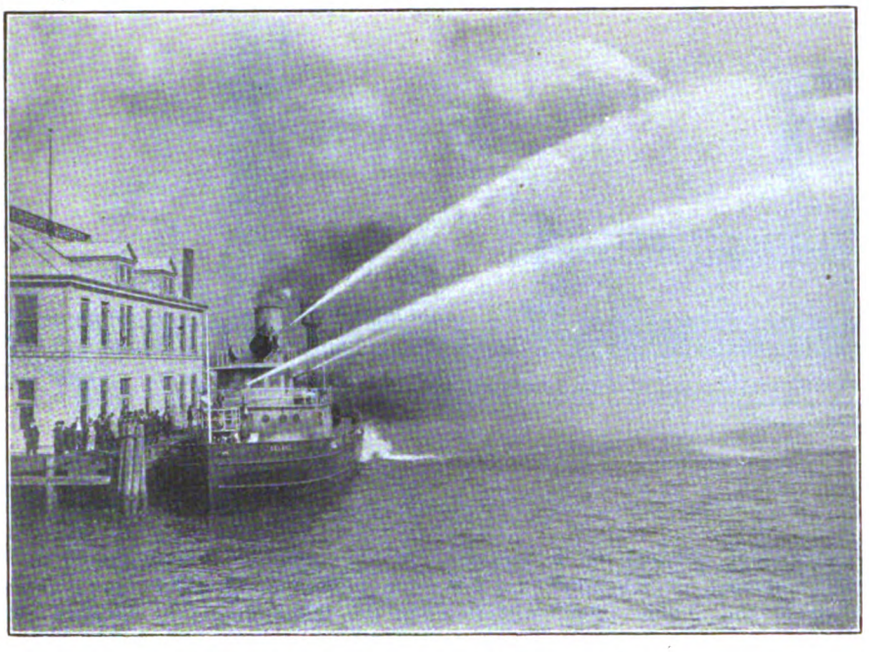


FIREFOAT DELUGE IN ACTION, LOOKING AFT.

Work at Fore River

The Fore River Ship Building Co. has contracted with the New England Coal & Coke Co., of Boston, to construct a steamer of the following dimensions: Length over-all, 406 ft.; length between perpendiculars, 389 ft.; breadth, molded, 54 ft. 6 in.; load draught, 23 ft.; depth molded to spar deck, 31 ft.; load displacement, 11,200 tons; deadweight cargo capacity, excluding bunkers, 7,200 tons.

This vessel will be similar in all essential respects to the Everett, Malden and Melrose, previously constructed for the same owners and will be completed in October next. She will be built to the highest classification of the British Corporation and the American Bureau of Shipping, and will be named Newton.

The battleship Aki, of the Imperial Japanese navy, is fitted with twin-screw Curtis marine turbines of 24,000 aggregate horsepower, furnished by the Fore River Ship Building Co., of Quincy, Mass., who also designed and furnished the propellers. This vessel in November and December last underwent steam trials, occupying approximately one month, with very satisfactory results. She was originally designed for 19 knots and reciprocating engines. The top speed with Curtis turbines was 20¼ knots and the navy department are highly pleased with the results, which exceeded all guarantees in every particular. The Aki is fitted with four 12-in. and ten 10-in. guns.

The Argentine battleship Rivadavia, now under construction, is about 48 per cent complete and will be launched during the coming summer. This vessel is to have a speed of 22½ knots and is fitted with Curtis marine turbines on three shafts, having an aggregate horsepower of about 39,000.

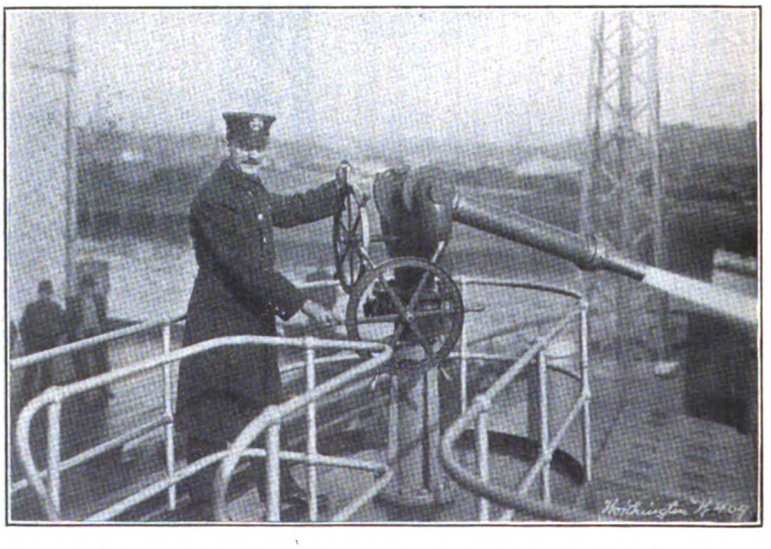
Pacific Coast Notes

Plans for an all-water freight line between Mississippi river towns and San Francisco were announced in the latter city, on April 19, by representatives of the California-Atlantic Steamship Co. A traffic agreement has been arranged between the company and the Mississippi Valley Transportation Co. of New Orleans, and freight rates of from 15 cents to 35 cents per 100 lbs. less than the present rail rates have been published. A traffic agreement has also been effected with a railroad line for transportation of Pacific coast freight from Chicago to St. Louis for transshipment. The time schedule from St. Louis to San Francisco is announced as 35 days, very little longer than the time consumed by rail.

The three big freighters of the Pacific Mail Co. are to be transformed to oil burners, according to a statement given out by a company official recently. The City of Para is now at the Union Works, having the new apparatus installed and the Aztec and Pennsylvania will be docked in turn as soon as the Para is completed. R. P. Schwerin stated recently that the company's engineers have estimated that at least $160,000 per annum will be saved by the substitution of oil for coal.

The German gasoline schooner, Triton, Capt. Henry Othmer, owned by the Jaluit Gessellschaft, a trading company, operating in the South Sea Islands, foundered off Pigeon Point on the Pacific coast, on April 18, soon after putting to sea from San Francisco, where the vessel had been given a general overhauling. The vessel was built at Benecia, Cal., in 1902, and has been in the South Seas until her recent arrival in San Francisco. The sum of $8,000 was spent in installing the auxiliary power and it was the first tryout of her gas engine at sea. The Triton had a capacity of 150 tons of freight. She was valued at $35,000, and was partly insured.

The Bendixsen Ship Building Co., Eureka, Cal., has started work on a new vessel for the McCormick lumber interests. The vessel will be 195 ft. in length, 40 ft. beam and 16 ft. depth of hold. She will have a capacity of 1,000,000 ft. of lumber and will have accommodations for 45 first class passengers and 15 second class.



OPERATING MONITOR FROM THE BRIDGE OF THE DELUGE.

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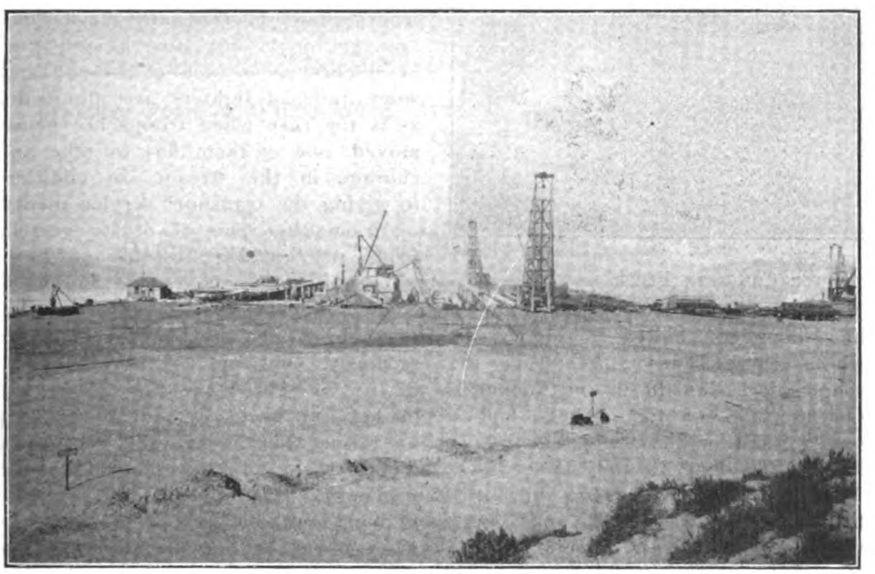
ARMY TRANSPORT DOCKS AT SAN FRANCISCO

ONE of the links in the chain of improvements which is taking place on the San Francisco waterfront is the system of docks being built for the United States army transport service at Fort Mason by the San Francisco Bridge Co., and which will be completed and ready for service by July 1.



THE FILL BACK OF THE SEAWALL, SHOWING UNCOMPLETED DOCKS IN DISTANCE, DEC. 20, 1910.

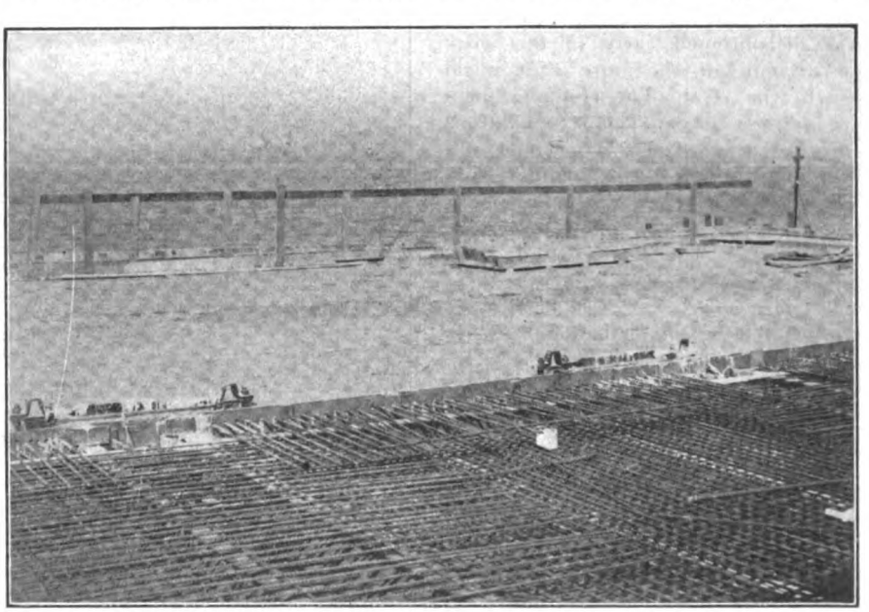
The improvement is being done at an expense of $1,182,000 and together with additional warehouses which are to be built on the docks, will represent an investment of $1,500,000. The improvement consists of a seawall and three large docks, together with warehouses for the storage of goods in transit between the United States and the Philippines. The piers will furnish accommodations for four transports having a length of 500 ft. and a draught of 31 ft. Plans have been made for the possible extension of the docks by dredging around them to a depth of 35 ft. The entire improvement is of steel and reinforced concrete, no wood being used in the permanent structure. The wharves will be covered by reinforced concrete sheds and two sets of warehouses will occupy the ground back of the seawall. Administration buildings and transport department headquarters are also to be built.

While the three wharves and sea wall will be completed in the time specified, but one freight shed, the one on the central wharf, is being built, the construction of the sheds on the two smaller wharves being held up pending additional appropriations of money by congress. In order that the two piers may be used, however, the reinforcing and connecting irons which will hold the structures in place have been bent parallel with the floors of the docks and covered with asphalt to protect them from the weather.

The work was commenced in October, 1908, and from start to finish has been under the supervision of Lieut. Col. George McK. Williamson, United States army constructing quartermaster.

The land on one side of the docks slopes down from the rocky headland of Fort Mason and on the other side tapers off to a long, smooth stretch of sandy beach so low that at high water the lots plotted on the city maps are under water. In order to furnish a solid foundation for the warehouses and to form the land approach to the piers, a sea wall 1,030 ft. in length has been run from the rocky headland diagonally into the bay, turning at right angles and running 500 ft. to the shore, where it joins the base of a hill back of the beach. Sand filling has been pumped into the space created by the wall, forming a smooth esplanade in front of the warehouses and piers. Beyond the front sea wall the three docks are located, extending 500 ft. into the bay. The central and double pier, 118 ft. wide, is flanked by two smaller single piers 81 ft. in width. Two 100-ft. slips separate the docks.

The maximum depth of the sea wall is 57 ft. and the maximum width at the base is 25½ ft. It is built in box form, the hollow spaces in the center being filled with sand, with a solid partition wall every 18½ ft. It rests on a bed of yellow clay excavated 10 ft. below dredge grade. The wall was constructed by use of cofferdams built in sections. As fast as the sections were completed the



REINFORCED BARS LAID PREPARATORY TO CONCRETING DECK OF WHARF NO. 1, OCT. 31

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water and mud was pumped out and the space filled with concrete deposited in air-tight buckets.

The wharves are constructed with underworks of cylinder piers, bottle-shaped, 7 ft. in diameter at the base and 4 ft. in diameter at the top. Cages of reinforcing bars are placed in the centers. Wooden and steel forms of sufficient strength to keep the water out were built and sunk to the desired depth and the mud and water pumped out, dry concrete being deposited inside the forms. After the concrete became set the steel jackets were lifted from the pier thus formed and used over and over again. In the case of the wooden jackets, they were allowed to stay where they were and will soon disappear with the ravages of the wind and tide. The use of the wooden forms was discontinued early in the work on account of the more economical use of the steel. The concrete piers are carried to hard clay foundations and in cases where clay could not be found a group of seven piles were driven and cut off 20 ft. below mean low water and the concrete structures built on the base thus created. The floors are what is known as a slab and beam type, the beams being supported by the pier columns directly and by brackets which extend on both sides transversely and longitudinally of the wharf and distance of 5 ft. beyond the faces of the columns. A distinct feature of the wharves is found in the fact that the tops of the floors are over 4 ft. higher than any other set of docks on the Pacific coast, in order to meet the needs of the latest and largest types of freighters in service and being built.

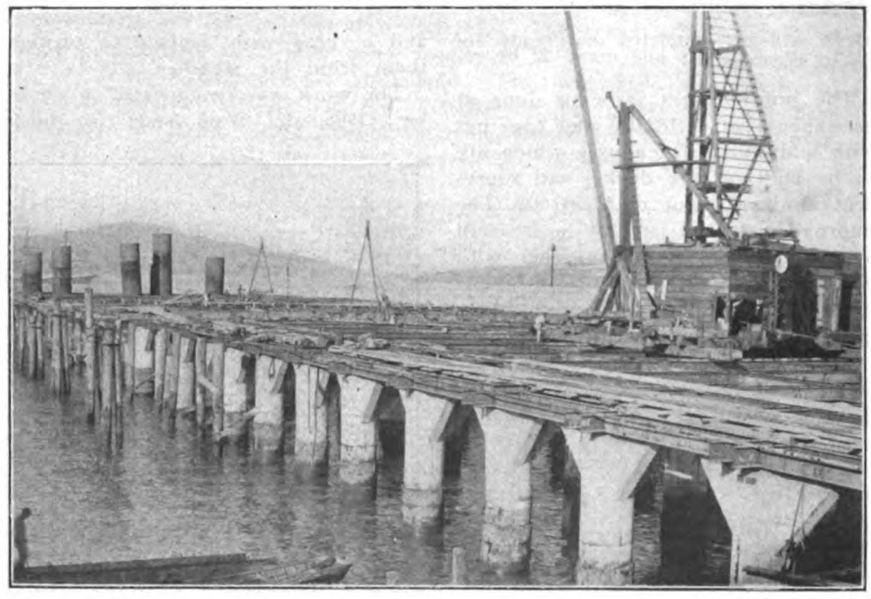
WHARF NO. 1 NEARLY READY FOR CONCRETE FLOOR.

The average length of the piers of each wharf is 56 ft. and they are set 18½ ft. apart. The decking of the wharves is of "I" beams over each line of piers bolted together, the whole encased in concrete in the shape of a slab 10 in. in thickness. On the top of the slab is laid a 4-in. asphaltum floor, which will hold 500 lb. live load to the square inch. Two railroad tracks extend the entire length of each wharf, and cargo will be unloaded direct to the cars. Electric motors will haul the trains from the wharves to the belt line railroad connecting the trans-continental railroads.

Twenty-eight thousand five hundred yards of concrete was required to construct the sea wall and 27,500 yds. was used in the piers. Eight hundred and fifty tons of reinforcing bars were required for the piers and 1,250 tons of structural steel. One hundred and twenty-five tons of bars were required for the sea wall. The cylinders supporting the piers in the wharves number 452.

Many difficulties were encountered in the preliminary work on account of its exposed position, both wind and tide sweeping in from the Golden Gate, playing havoc with the work as fast as it was installed.

The completion of the docks will materially assist in relieving the present congestion on the eastern waterfront, where the transport service has but one dock. But two vessels can be docked at a time at present and when railroad lighters are alongside, as is the case when troops are being moved, one of them has to take anchorage in the stream. In addition to giving the transport service plenty of room the removal of its vessels from the eastern to the northern waterfront will give space for merchant vessels. It was only recently that the Alaska Packers' Association seriously contemplated the removal of its vessels from San Francisco on account, as it claimed, of the lack of room. This need has been met temporarily and the removal of the transports together with the completion of docks being built by the state of California will give more room for the rapidly growing shipping business of the port.



INSTALLING STRUCTURAL STEEL FLOOR BEAMS ON WHARF NO. 2, JAN. 15, 1911.

The Northern Dredge & Dock Co., Duluth, Minn., was the lowest bidder for dredging in Port Wing harbor, Wis. Their bid of $6,345 was accepted.

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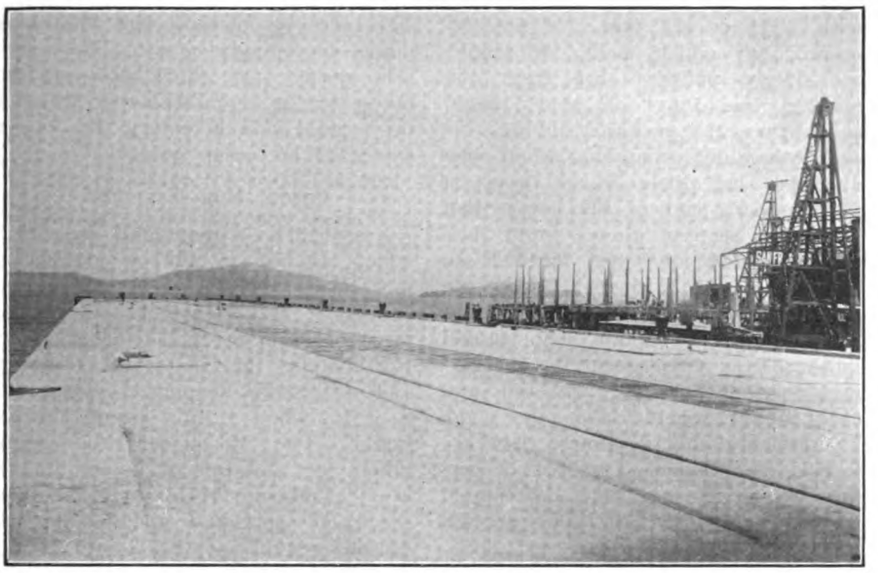


FINISHED FLOOR OF WHARF NO. 1, APRIL 20, 1911, SHOWING RAILROAD TRACKS IN CENTER.

Random Notes on a Lake Freighter

BY REAR ADMIRAL CASPAR F. GOODRICH, U. S. N.*

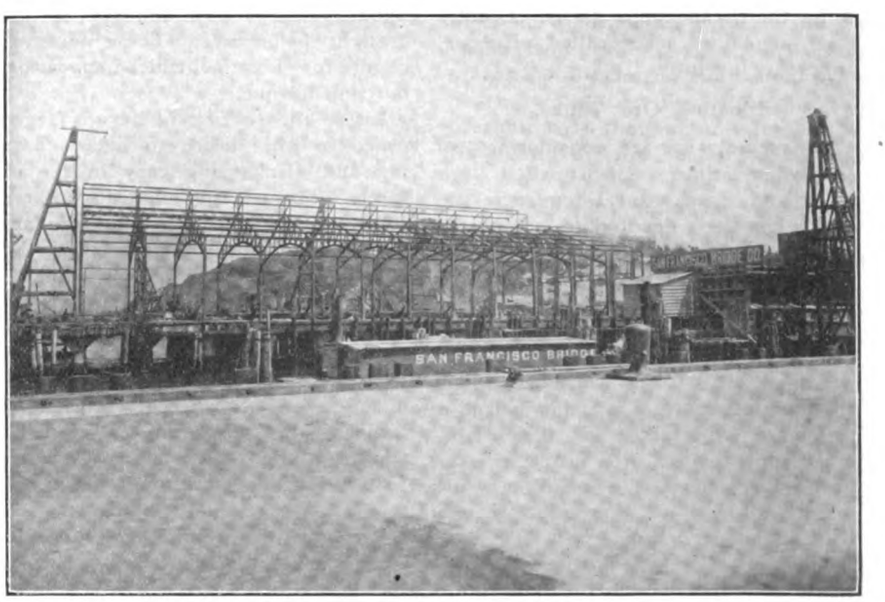
DOUBTLESS to many of my brother officers this brief article will seem like the proverbial bringing of coals to Newcastle, for they have lived upon the shores of the great lakes and have witnessed, if not the birth at least the development of its colossal shipping trade, but the rest of us have never enjoyed this great privilege and our notions, gained through casual report, must be, as my own were until recently, vague in the extreme. Having within the last few weeks enjoyed an opportunity of regarding this fresh-water system at close quarters, it would not appear out of place to lay before my fellows of the Naval Institute the fruits of my inquiries as embodied in notes made on the occasion.

Remembering the saying of the profane old English statesman, that there were lies, blank lies and statistics, I shall only remark that those who are in a position to know estimate the cargo tonnage which passed Detroit and the Sault Ste. Marie in the calendar year 1909, at 72,000,000, more than three times as much as went through the Suez canal, and more than twice as much as the total tonnage entered and cleared at the ports of Liverpool and London. Of this amount 42,000,000 tons were of iron ore brought from Lake Superior to ports on Lakes Michigan and Erie; and 17,000,000 were of coal sent north. The balance was lumped under the head of general merchandise, or, as the local expression runs, "package freight." Surely such a vast movement justifies a few words touching the build of the ships that do the bulk of the work and the methods by which they are operated.

In the first place, it must be remembered that the season is ordinarily only eight months long. By the middle of December navigation is closed, to open again the middle of April. It follows, then, that the most must be made of the period available, hence fairly good speed between ports and the briefest possible delay while at rest are imperative. These conditions having been frankly recognized, dominate the whole scheme. Confining my remarks to the transit of ore, I may point out the necessity at the one end of having that material in readiness on the ship's arrival and so stored as to be loaded into the hold with the utmost dispatch, and, at the other, of discharging it in the least possible time. It is of record that the W. E. Corey was, on one occasion, but an hour and a half at Two Harbors from the time of entering until leaving again, having in the meanwhile taken in some 10,500 tons, the exact loading time being 39 minutes. This large cargo was taken out of her in four hours and a half. Such figures seem incredible until the appliances by which they are achieved are examined, when all becomes clear. The Corey made 38 trips in one season and transported about 400,000 tons of ore.

Loading Ore Into Vessels.

In some ports a mammoth crane lifts an ore car from the railway tracks, swings it out over the vessel, capsizes it and shoots its 50 tons of ore down a hatch, but usually the ore is held in large bins 30 ft. and more above the wharf. From these it is run down in steel chutes about 4 ft. wide, semi-circular in section, which are invariably 12 ft. between centers, a constructional detail that,



SIDE VIEW OF SHED FRAME OF WHARF NO. 2, SHOWING FLOOR OF WHARF NO. 1.

*The United States Naval Institute Proceedings.

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whether wise or unhappy, must be followed in the spacing of the vessel hatches. However long or short the steamer may be and however wide her hatches, as measured along her midship line, or however broad, measured athwartships, they are exactly 12 (or 24) ft. apart from center to center, except where deckhouses intervene to make that distance an exact multiple of 12.

The discharging apparatus is based on the clam-shell dredge, which is lowered into the hold to grab its charge, then elevated, swung back over the dock and emptied into gondola cars, or into carriers that convey the ore athwart the dock and dump it upon piles where is accumulated the winter's supply for the ravenous furnaces at Pittsburg, Cleveland and South Chicago. The latest shape this device has assumed is shown in the Hulett unloader. The long vertical member is kept vertical at all times by means of the movable levers, which, with the fixed upright, form a parallelogram. This arm carries the buckets, and can be raised or lowered at will. The buckets, moreover, are susceptible of turning in a horizontal plane about their vertical axis. Through these movements the buckets can rake up the ore in a nearly fore-and-aft line, form a heap and then gather up their huge charge of 15 tons at a hoist. The operator is stationed inside the vertical member at its lower extremity so that he descends with the buckets into the very hold of the ship for each load. Everything is done by electricity and so complete is the control that the buckets seem to be almost human as they search the corners of the ship and scrape the scattered ore together before seizing it in their capacious maws. Locally these machines are called Huletts, after the inventor.

Floating Ore Tanks.

The vessels we are considering are simply floating, self-propelled ore tanks and, as a natural sequence, the entire length is devoted to ore carrying except enough at the stern to contain the boilers, engines and a portion of the crew with their accommodations, and at the bow, more quarters, the wheel house, steam windlass, etc. When looked upon as an adaptation to a specific purpose they are admirable. In their general appearance, the beautiful has been sacrificed to the useful, as this picture of the J. Pierpont Morgan will abundantly prove.

The upper deck is flush from forecastle aft, broken only by the transverse hatches (in some cases 36 in number) fitted, in the later vessels, with steel covers that are not removed, but which, being telescopic, are simply pulled apart from the midship line by hook ropes taken to winches, the sections sliding over each other and occupying, when thus disposed, but little more room at the outboard end of the hatch than does one section alone. Stout tarpaulins and handy steel battens are always ready, as with us. During the summer they are seldom used, but he is a foolish captain who should fail to batten down securely, on leaving port during the late fall and early winter, for the lake gales come up suddenly and, at times, they are terrific in violence. The loss of certain freighters has been attributed to neglect of this particular precaution.

Type of Machinery.

The engines are habitually triple expansion and the Scotch boiler is still the prevailing type. All lake freighters have but the single screw.

As a rule the officers and crew are most comfortably quartered. Hammocks are unknown, berths being provided for all.

It is only in length that these vessels can be increased. The draught is inexorably limited by the depth of water at the shallow places between Lake Erie and Lake Superior to about 19 ft. and 6 in. The beam might be somewhat greater than the present maximum of 60 ft., the widest that can pass through the Weitzel (American) or the Canadian lock at the Sault Ste. Marie,* were it not for the loading and unloading now based on a beam not exceeding 60 ft. To alter these would be so expensive an undertaking that we may believe the width of these ships as firmly fixed by man's own doing as is their draught by nature. These facts account for lengths which appear almost grotesque.

Inside the scheme of design is governed by the desire to make charging and discharging easy in the extreme. Thwartship bulkheads (except such as to divide the hold into separate watertight compartments) and stanchions are fast disappearing in favor of an arch construction which makes each hold an open box-like tank. The stresses on decks and keelsons, as the top and bottom members of the great fore-and-aft girder, must give the naval architects of the lakes much concern. Not being an expert in these matters I can only suggest that possibly the requisite strength in these respects is secured, in part, by carrying the double bottom well up on each side, and by making the spar-deck plates exceedingly heavy. These vessels survive the short seas on the lakes, but it is questionable whether they could ride in safety the longer waves of an ocean gale.

*The Poe (American) lock has gates 100 feet wide.

Cargo Not Trimmed.

I noticed no trimming of the cargo, which is left in the comparatively low heaps formed by the dumping process. Experience has doubtless proved trimming to be unnecessary. Fortunately the material is heavy and not easily dislodged, else might a shift, when rolling deeply, prove fatal. The Marquette ores, being mined wet and full of jagged lumps, are thus presumably more staple than the earthy material quarried in the Mesaba region back of Duluth.

Most, if not all, of these freighters are provided with accommodations for a few passengers, since officials of the owning companies have occasionally to go in them on tours of inspection. During the summer months, a round trip from Lake Erie to Duluth or Two Harbors is extremely enjoyable and is coveted by many, both men and women, who possess, or think they possess, some claim on the owner or shipper. Hence, freighters though they be, they seldom go, at this season, without a full complement of guests. The quarters range from the bare comfort of a plainly furnished sleeping room and a seat at the table, where, often, all mess, except the firemen and deckhands, to handsomely equipped private suites and a separate dining room.

The personnel of the Zenith City, in which I was privileged to make the run to Marquette through the politeness of H. Coulby, the general manager of the Pittsburg Steamship Co., comprised a captain whose salary may have been about $2,200 (£440) per annum, a first mate at $130 (£27) per month; second mate at $90 (£19), four wheelsmen and watchman at $50 (£10); a steward at $90 (£19), an assistant at $36 (£7 4s); a porter at $30 (£6); a chief engineer at $175 (£35); one assistant at $125 (£25); one handy man at $65 (£13); two oilers and four firemen at $52.50 (£10 10s); six deck hands at $31.50 (£6 6s). This, by the way, is the usual complement. The steward is also the cook, and the food he prepares is the same for everybody, from the captain down. Excellent prog it is too—yet it is related that, on board one ship several years ago, before the introduction of "the open shop" and the defeat of the seamen's labor union, the firemen struck because the potatoes were not mashed. The passengers, in

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this case, happened to be a husky lot, who pitched in, shoveled coal and so brought the vessel into port.

Punishment is by fines, as it should be.

Lack of Respect for Obligations.

The men ship for the month, or for the round trip, and are paid by checks signed by the captain. As we have too often found among our recruits in the navy, there seems to be a lack of respect for the obligations of the contract of enlistment on the part of these freighters' crews, who make no bones of enlisting in ports of the lower lakes for the purpose of securing a free passage to Duluth and Two Harbors, where they desert at pleasure and take trains for the wheat fields of the northwest during the harvest season, when wages are exceptionally high. This remark applies particularly to the deck hands, whose work is almost nil while underway (they stand no night watch), and who are only really busy when in port, attending to the lines for moving the ship from empty bins to full ones or performing other services connected with the operations of loading and unloading.

It may be observed, by the way, that the absence of tide frees moving alongside the wharf from some of the inconveniences experienced in salt water and that frequent bitts on the dock stringer, together with steel lines, with permanent eye splices at the ends, worked from steam winches on the spar deck, reduce this maneuver to its simplest terms—tossing the end ashore, throwing it over a bitt and heaving in. The winches are four in number, two just abaft the Texas deck and two just forward of the after deck house; two facing to port and two to starboard.

Language of the Sea Modified.

The language of the sea has suffered material modifications in its transmission from the ocean to the lakes. For example: "Aye, aye, sir" has given way to "All right," "Ease your helm" to "Slowly," not to mention others equally significant.

Boatswains and their whistles are unknown. Men are called to meals by the "porter" or "assistant steward," who passes along the deck ringing a hand bell. This seems to be quite as effective as the cheery "pipe to dinner" of our service.

Some of the larger companies (the Pittsburg company reckons 22 barges and 78 steamers in its fleet) are gradually introducing customs similar to those on ocean-going craft, such as striking the half hours on the ship's bell and restricting promotion to men and officers in their own employ. The Cleveland-Cliffs Co. forbids the latter to appear on shore while attached to a ship in port, except in its prescribed uniform. That an improved esprit de corps will be effected by such measures admits of no doubt.

Tow Barge Passing Out of Existence.

The helpless barge, towed by a collier, is passing out of existence. While an economical method of conveying freight in bulk, as the practice on our Atlantic seaboard abundantly proves, the annoyances attending locking through the Soo and getting alongside of dock, together with the risk of disaster in heavy storms when the freighter's power is barely sufficient for her own needs, have acted as discouragements. I cannot say whether the employment of stout, seaworthy tugs has ever been the subject of practical trial. Doubtless this has been thoroughly studied, or these barges, some of which carry 8,000 tons of ore, would not now be in process of abandonment.

As may be imagined, the storage of provisions and of potable water gives little concern, since the trips are but three or four days in length between terminals and the navigation is in fresh water.

The speed and all distances are measured in statute miles. About 11 miles an hour empty and 10 miles when full seem the average.

Engines of Low Power.

The engines rarely develop over 2,000 horsepower, which in heavy gales, when the ship is light and largely the sport of the winds, must cause some uneasiness. The latter inconvenience is neutralized by letting water into the double bottoms. The jet condenser is universal. Despite the poor vacuum it yields (say 22 to 24 in.), these vessels are very economical in fuel. The Peter White, with 1,560 horsepower, for example, gets one horsepower for 1.7 pounds of coal, and she burns but 270 tons during the round trip of six days, yet she carries 9,000 tons of ore. The J. E. Upson, of the same capacity, on the same coal expenditure, develops 1,950 indicated horsepower, and makes 12 miles an hour when light.

There are numerous instances of coal consumption of 1.6 per horsepower and even less.

An automatic feed replaces the water tender.

Electric lighting is the rule.

Naturally, external corrosion of the hull and fouling, the banes of our existence, are unknown. The interior of the vessel is either red leaded, as with us, or is coated with a special black mineral oil, which has proved both cheap and effective.

The steering engine is commonly placed under the wheel. It is, however, also found in the engine room—a better location, of course. I heard some complaint of the telemotor by which this engine is controlled from the pilot house, and I gathered the impression that captains, as a rule, prefer to have the steering engine directly under their feet.

Captains Are Skillful.

The handling of these long craft gave me a favorable impression of the skill of their captains. A tug was used at Ashtabula in getting clear of the dock and out into the open lake, but neither the captain nor I thought this assistance necessary on that occasion, however valuable when the wind is blowing fresh. At Marquette we ran alongside the wharf as easily as possible and tied up at once. I could have wished more difficult conditions in order to observe better the captain's dexterity, although I have no doubt of his successfully meeting any requirements.

Of navigation, properly speaking, there is no trace on the lakes, for land is in sight the greater part of the time, and determining the ship's position by astronomical methods is quite unknown. The nearest approach is in ascertaining the compass error by the sun's shadow, his true azimuth being taken from tables. On the other hand, coasting and piloting obtain. In the former operation I did not notice the strict keeping of the run, as is customary with us, and the plotting of the ship's place on the chart, from time to time, by means of cross bearings, bow and beam bearings and the like. Probably this precaution is thought unnecessary, so frequently do the captains pass over the same ground. That a risk is incurred by not following our deep-water practice I am disposed to believe. The time is always recorded in the log when certain well-known headlands, etc., are abeam, together with the reading of the engine revolution counter dial. The log book is most simply kept. It contains but the barest story of the run. There are no divisions into watches, and several days' proceedings may appear on one page. The columns are marked as follows, viz.: Date, time, place to place, distance off, time from last place, upper compass, lower compass, on the left-hand page; wind, weather, revolutions last six hours, revolutions, place to place, remarks,

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on the other. Temperature and barometer heights are absent and the remarks column is mainly a blank.

As Pilots at Their Best.

In piloting these captains are at their best. So far as my observation went they are masters of this art. Much has been done by the lighthouse board to make the passages over difficult points absolutely safe; lighthouses, beacons and buoys abound. In narrow places the channel is marked by buoys on either hand, which are lighted at night. It is only a question of keeping between them. Indeed, once entered there seems to be no more difficulty in getting through than of walking down Fifth avenue. Then, too, under the river and harbor acts the government has already spent some $50,000,000 (£10,000,000) in removing obstacles, building locks at the Soo and in cutting long, straight channels miles long, sometimes through dry land, to replace the tortuous navigation previously encountered. Again, these artificial waterways are, not infrequently, two in number, that vessels may not meet in narrow waters—a double-tracked road, so to speak. In addition to the buoys, they are provided with range targets and lights, leading when in line directly down the axis of the channel and furnishing incidentally a rigidly exact method of finding the compass error on that particular heading. A convenient blank book suitably ruled is in use by these captains for entering the observed headings by the standard and steering compasses at no less than 16 such localities on the Detroit and the St. Clair rivers, and 21 on the St. Mary's river between Lakes Huron and Superior. There can be no excuse for ignorance of the local deviation. Verbal communication between the pilothouse and engine room is usually by telephone. Signals to the latter are most frequently by the ordinary engine-room telegraph, now gradually replacing the small steam whistle once exclusively used. The latter is still retained for cases of breakdown in the telegraph.

A stout trolley wire, carrying a boatswain's chair, is stretched between the bridge and after deckhouse. Its value when the spar deck is swept by a heavy sea needs no explanation. This appliance is obligatory. Its need was made clear (in 1805) when a certain steamer, the Mataafa, of the Pittsburg Steamship Co.'s fleet, having run ashore in a violent storm, all her crew stationed aft were lost through inability to reach the bow, for there is no passageway between the ends of the vessel below the upper deck.

Heavy Weather in the Fall.

Speaking of weather, the late fall and early winter are apt to exact a heavy toll, especially on Lake Superior, with its rock-bound coast, lack of sea room and paucity of refuge harbors. In some seasons the wrecking of steamers and destruction of life are almost appalling. I am confident that some of this is needless, that it might be avoided if captains realized the possibilities which reside in good round tackle skillfully managed. While very deep, say 200 fathoms in parts, Lake Superior has a clay bottom with a gradual slope towards the shores. Remebering what anchors did for our blockading fleet, were I caught in a menacing Lake Superior gale, I would shackle both chains to one anchor, and lower the latter down to extreme scope—about 180 fathoms. It would first act as a drag to keep the bow towards the sea, then it would touch the bottom with increased efficiency, finally it would catch in this best of holding ground and eventually bring the ship up long before she struck the reefs. The captains with whom I discussed this matter thought well of the proposition (for the originality of which I disclaimed any credit) and said they would adopt it on the first opportunity. One, Captain Murphy, of the Peter White, stated that he had tried it once, but a defective link parted and he was obliged to battle for safety with his engines alone.

Locking Through the Soo.

Locking through the Soo is an interesting operation and performed with great dispatch. Two locks are in use on the American side and one on the Canadian. There are no charges. A third and still larger lock is building by our army engineers. The difference in level between Huron and Superior makes a lock imperatively necessary. Doubtless the fact that the lakes' people are accustomed to this unavoidable process accounts for their general approbation of locks at Panama, a feature in our trans-isthmian canal as unnecessary as it is deplorable.

The return to Lake Erie I made on the J. E. Upson, Captain J. G. Wood, through the politeness of Captain Wm. Morton, manager of the Wilson Transit Co., of Cleveland. The steamer herself is among the larger of her kind, but not among the largest, having 30 hatches, while the maximum is 36. She is, therefore, 72 ft. shorter than the J. Pierpont Morgan. I found her captain alert and competent, as well as thoughtful host, and her accommodations almost luxurious.

Speaking in general terms I should say that the lake captains are quite as skillful in their more restricted employment as our battleship captains are in theirs, which embraces so much larger variety of incidents. Greater praise could not be given. From among the number of these fresh-water sailors excellent men can be drawn to help us out in time of war, for their intelligence is of a high order and they can quickly learn what is not, at present, of their experience.

Surprise at Absence of Turbines.

Some surprise I felt in the absence of turbine engines in these freighters. Doubtless these may arrive some day provided the screws do not project so far from the midship line as to embarrass the operation of getting alongside the dock.

Nor has oil burning been attempted in spite of the proximity of the heavy oil field of Lima and of the advantage of eliminating the fireman, just now well in demand, but liable at any moment to prove, as of old, the source of infinite trouble.

The charts in use, while accurate, presented one feature which is not free from danger. The courses from place to place, as marked, appear to me, in some instances, to shave the headlands or outlying reefs altogether too closely. In clear weather this is no drawback, but in fogs or thick weather a slight deviation from the correct magnetic heading might run a vessel ashore. It may be argued that a captain ought to disregard the chart course under such circumstances and give the next obstacle a wider berth than a mile and a half. Quite true; but a safer plan, according to my view, is to prescribe a course which will carry the vessel in good water at all times and yet leave a comfortable margin for error, for, being given on a government publication, it is naturally followed by the captain, who looks upon it as official.

It is hoped that my random notes may be found readable, if not profitable, by my colleagues of the naval service. In these days of marvelous and rapid development one never knows when some little scrap of apparently unrelated information may "come in mighty handy."

Fire destroyed the river steamer, Captain Webber, at San Francisco, April 5, entailing a loss of $100,000 on the vessel and cargo. The vessel was the oldest on the San Joaquin and Sacramento river runs and was owned by the California Transportation Co.

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Oil Fuel Vs. Coal in Transport Service

THE recent adverse report of Brig. Gen. Aleshire, quartermaster general of the army, regarding the use of fuel in the transport Thomas, has raised a storm of protest from all sections of California. Not only do the oil men, who are the most vitally interested, take exception to the report, but prominent engineers and ship masters state that the officer's points are not well taken and that they lack careful study of the merits and demerits of oil burning.

The following, from the California *Oil World* of April 20, in which Frederick S. Samuels, of Oakland, meets the quartermaster general's criticisms, is a very complete summary of the entire situation:

The report of Gen. Aleshire is in light face and the comments of Mr. Samuels are in italics.

To the Secretary of War (287359)—Sir: I have the honor to enclose herewith several communications received in this office regarding the installation of oil-burning apparatus in the boilers of the army transport Thomas. After a full consideration of the subject in this office, it is respectfully recommended that oil as a fuel be disapproved by the war department for use on the larger vessels of the army transport service until the conditions in connection with its use are much more favorable than at the present.

When will the conditions in connection with the use of oil ever be more favorable than at the present? Its economy is beyond question as compared with the heat units of coal, and its safety in use can be insured against everything except a deliberate attempt to cause a casualty.

It is argued that fuel oil has various advantages over coal as fuel for boilers of large steam power plants, but it is the opinion of this office that the greatest possible safety of the power plant of any army transport is so vitally important that the use of oil as fuel on a troop ship should not be authorized.

As to Safety.

Is the safety of those on the army transports so much more vitally important than the safety of the lives of millions of others who are being yearly transported on vessels which use oil as fuel, and which vessels are recognized by the insurance companies and the United States inspectors of hulls and boilers as being perfectly safe, as far as the vessels themselves are concerned as well as the passengers carried?

The navy department has officially informed this department, in response to inquiry, that with a properly installed and carefully operated fuel oil system there is no considerable danger of accidental explosions, but that it is generally considered that greater care must be exercised to prevent accidental explosions from the use of fuel oil than where coal is used, this apparent necessity for greater care being probably due to our lack of experience with oil as compared with coal.

The navy department is correct in stating that with a properly installed and carefully operated oil fuel system there is no considerable danger of accidental explosions. The commercial use of millions of barrels per annum of oil proves that with properly installed and carefully operated fuel systems there is absolutely no danger of accidental explosions. There is even less danger of an oil explosion under these conditions than there is of a boiler or steam pipe exploding.

This department does not feel assured that oil-burning apparatus installed on its ships would always be so carefully and satisfactorily operated as to eliminate entirely the possibility of an explosion, as the crews of all its vessels are now well experienced in the use of coal fuel but are practically without experience in the use of oil.

Insufficient Management.

This statement implies a grave suspicion of the management of the transport service as compared with the management of commercial lines. Commercial lines are always assured that their oil burning apparatus is carefully and satisfactorily operated, and have never found any difficulty in securing men of sufficient intelligence to operate with oil with the same safety as with coal. In fact, only one-fourth of the number of crew would be necessary for the use of oil, as against the use of coal, and this one-fourth of the number of men would be selected simply with a view to ordinary intelligence.

And the terrible catastrophe that might result from an explosion or fire on an army transport with 2,000 or more troops and passengers aboard, with ruptured tanks and floating fuel oil aflame on every side, is so appalling that it is believed that this form of fuel should not be used by the transport service, at least until after the large commercial lines operating first class passenger vessels across the Pacific ocean have proven beyond a doubt that oil fuel can be used advantageously, economically and with safety.

The horrible picture here depicted might be realized by the explosion of any one of the numerous boilers in the vessel, which is just as likely, and even more likely, to occur than the explosion of the oil tank. It is likewise gratifying to note the extraordinary care taken by the government to transport its troops with safety to where they may be placed in a satisfactory position to be exterminated by the enemy's bullets. Of course, in the handling of millions of the common people, who are transported on oil-burning vessels, neither the owners of the vessels, the insurance companies, nor the United States inspectors, nor even the travelers themselves give this appalling calamity a possible amount of consideration.

Have not the large commercial lines of first class passenger vessels on the Pacific coast for the past several years proved beyond a doubt that oil fuel can be used advantageously, economically and with safety?

Two Numerous "Accidents."

Numerous serious accidents are of record due to the use of oil fuel on ship board. The steamship Progresso was on Dec. 4, 1902, blown open and sunk at its dock in San Francisco harbor; a fatal explosion recently occurred on the United States battleship Delaware, and until such dangers have been more satisfactorily eleminated by development and experience with this kind of fuel, its use on vessels engaged in transportation of troops and officers is considered improper.

It is extraordinary that out of the so-called "numerous serious accidents" of record, only two are selected, one on the steamship Progresso, which occurred in 1902. This was occasioned by lowering a lighted candle into an oil tank while the ship was being repaired and before the oil tank had been properly cleaned up. It is quite possible to blow up a gas meter with the aid of a lighted flame, and also to explode a dynamite factory by striking a spark.

Practically nothing can be made absolutely fool proof, but it is to be expected that those in command will be able always to make their selection from men of ordinary intelligence instead of fools, and because the Progresso was blown up, and the battleship Delaware had a disaster, it is considered improper that the transport service shall burn oil, which

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implies a low grade of intelligence being employed in the transport service.

The most extraordinary feature of the quartermaster's two examples of "serious accidents" exists in the fact that the Delaware explosion was not due to oil, but to a lack of water in the boiler. It is respectfully submitted that a boiler will explode when the water gets too low regardless of the character of fuel in the furnace.

The department has for the past few years been installing oil-burning apparatus on the smaller harbor steamers of its service, but it is felt that the installation of such apparatus on the Pacific transports should be postponed until the advantages, economy and safety of its use have been fully determined from the smaller harbor installations.

If the advantages and economy of the smaller harbor installations are to determine whether the United States transports shal use oil as fuel, then this question may be dropped entirely, from the fact, which will appear later on, that these smaller harbor installations are being operated in a manner which gravely reflects on the management or intelligence of those in charge.

From careful analysis of log reports regularly received in this office, the claims of advocates of oil fuel regarding its economy as compared with coal are not borne out, and attention is invited to enclosed statement regarding fuel consumption of the three harbor steamers, General Mifflin, General Greene and General Jesup, which are of the same size, design and built under practically the same specifications throughout with exception of fuel arrangements.

Fatal Commercially.

I agree with the statement herein that the claims of the advocates of oil fuel are not borne out by the regular reports of the General Mifflin, and it would be fatal to the successful operation of any commercial line using oil if it wasted that fuel in the same remarkable manner as it is apparent that it is being wasted on the General Mifflin. This will be referred to later.

The transport Thomas, referred to in accompanying papers, is now undergoing extensive repairs at San Francisco, and will not be available for service for some months to come. It is believed that the present contract should not be further complicated by the extensive work involved in the providing of the necessary fuel tanks and installation of additional pumps and other apparatus necessary in connection with oil burning system.

The present arrangements for the supply of coal fuel to the transports are fairly satisfactory and economical and it is not desired to increase the difficulties by being required to provide oil fuel for some ships and coal fuel for others, it being preferable for many reasons to follow the same arrangements of fuel supply for all transports alike.

If this report had been confined to the statement above it would have covered all that could have been reasonably said on the subject.

The expenditure of $100,000 or more to equip a transport with the necessary apparatus to permit the use of oil fuel is believed unwarranted in view of the present age of the vessels now in the service.

A Good Old Age.

The present age of the vessels, particularly of the transport Thomas, has not operated to prevent the expenditure of between $550,000 and $600,000 on the reconstruction of the vessel; it must therefore be assumed that a hearty old age is expected for her by the department.

STATEMENT.

Showing cost of fuel for steamer Mifflin, San Francisco harbor.

OIL VS. COAL.

As Determined from Reports of Public Service Rendered for the Period July 1, 1910, to Dec. 31, 1910.

Actual cost of oil used by the Mifflin at present contract rate,

$1 per bbl., 7,529 bbls.....$7,529.00

If coal had been used for this service instead of oil, it is estimated that it would have required 1,287½ tons, which at $5.85 per ton, which is the price of coal now being used by harbor boats in San Francisco harbor (brought by transports from Japan) would amount to $7,531.00.

The estimate of coal required to perform the service as rendered by the Mifflin is determined as follows:

The coal consumption of the General Greene (a sister boat) was 829 tons for six months.

The coal consumption of the General Jesup (another boat of same design, size, etc.), was 734 tons in six months.

The Greene was running 978½ hours and covered 10,100 miles.

The Jesup was running 1,043 hours and covered 7,734 miles.

The Mifflin was running 1,480 hours and covered 10,859 miles.

To perform the same number of hours service running as reported for the Mifflin and Greene would require 2,753,513 pounds, or 1,229 tons coal, and the Jesup would require 2,490,020 pounds or 1,112 tons for six months. The average of these two boats is 1,170.5 tons for six months.

As coal received ex-transport at San Francisco is about 10 per cent less efficient than coal used on the Greene and Jesup, it is fair to allow the Mifflin 1,287.5 tons coal (1,170.5 plus 10 per cent) for the work performed by the 7,529 bbls. of oil actually used. This would make the cost of oil and coal practically identical.

On a basis of mile per mile, and allowing the Mifflin 10 per cent more fuel than the average consumption of the Greene and Jesup on account of poorer quality of coal at San Francisco, the service rendered by the Mifflin should have been accomplished on approximately 1,058 tons, which at $5.85 per ton would cost $6,189.30
and the actual cost of oil fuel was 7,529.29

Meat in Statement.

The meat of this statement is contained in the last clause, and these log reports are relied upon to prove that the claims of advocates of oil fuel, regarding its economy as compared with coal, are not borne out. Let us see. The last clause is as follows:

> On a basis of mile per mile, and allowing the Mifflin 10 per cent more fuel than the average consumption of the Greene and Jesup on account of poorer quality of coal at San Francisco, the service rendered by the Mifflin should have been accomplished on approximately 1,058 tons, which at $5.85 per ton would cost $6,189.30
> and the actual cost of oil fuel was 7,529.29

The service rendered by the Mifflin should have been accomplished on 1,058 tons of coal.

As a matter of fact, she used 1,123 tons of oil. In other words, 64 tons more of oil than of coal. This is probably the only case on record where the heating efficiency of a ton of coal excelled the heating efficiency of a ton of oil, and does not reflect great credit on the transport service. According to the figures as stated in the above clause, the Mifflin could have saved $1,340 by using coal instead of oil. The Mifflin used 6.70 barrels of oil as an equivalent to one ton of coal inefficiency. Under ordinary commercial usage from 4 to 4½ barrels of oil, according to the size and character of the installation of the plant, are equal to one ton of good coal; under ordinary commercial ownership practice only 4,883 barrels of oil should have been used to perform the service in mileage that was performed by the

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Mifflin. There should have been a saving, therefore, in the use of oil as compared with coal of $1,306.30. Under the showing made by the Mifflin, however, there is an absolute loss in economy between 7,529.29 barrels and 4,883 barrels, which, at $1 per barrel, is $2,646.29.

Mere Suggestion.

As the transport service have obtained an opinion from the navy department as to the safety of oil, would it not be advisable for them to submit the log of the Mifflin to the navy department, and obtain an opinion as to the consumption of fuel on that vessel?

I cannot refrain from again reflecting on the question of safety in the general use of oil. It is used in private houses for heating, where it is handled by domestics. It is used in all kinds of industrial enterprises, in buildings for heating, running elevators, etc., as fuel in factories of all kinds; in tugboats, launches, locomotives, steam schooners, steamships, and, in fact, wherever coal or wood are used. It is handled by women as well as by men, and by those of many different nationalities, persons of ordinary, and in some cases less than ordinary intelligence, and yet it is most infrequent to hear of any accidents due to its use, compared with the vast amount of oil consumed. Is it believable that the transport service cannot with equal safety use this class of fuel?

DIESEL MARINE ENGINES*

By Herr Th. Saiuberlich, of Osterholz, Scharmbech.

SINCE the days of the old low-pressure steam engines there has been no time when marine propulsion attracted more attention than today. In the place of the highly developed steam engine, the efficiency of which it appears impossible further to increase, the Diesel engine is now making its way for marine purposes. It is at the present moment the most perfect oil engine. According to recent experiments, the heat efficiency amounts to from 33 to 35 per cent, against 23 per cent with gas engines and 13 per cent with the best superheated steam engines. This arises from the direct burning of the fuel in the cylinder, by which means perfect combustion is attained.

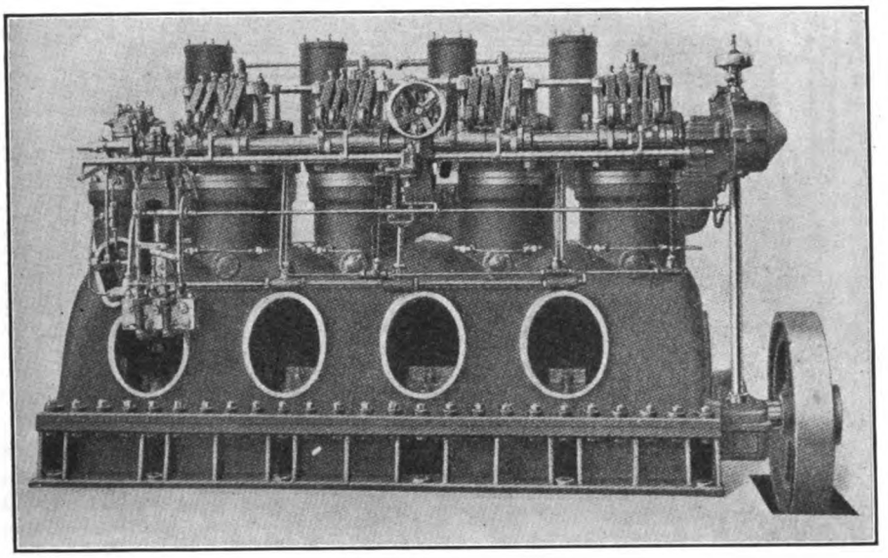

Fig. 1—200-Horsepower Reversing Diesel Engine of the Frerichs.

In its manufacture the Diesel engine is known to demand the greatest care in the choice of materials for most of its parts. But in view of the present-day knowledge with regard to metals, and the ease with which every sort of high-class and suitable material specially adapted for its purpose can be obtained, and above all, in consequence of the vast strides made in machine tool manufacture, there is no particular difficulty in turning out Diesel engines.

The large Diesel motor is very similar in its construction to the steam engine, and its development will, like that of the large gas engine, follow the example set in steam engine construction.

The prejudice against Diesel motors which still exists in ship building circles has to a great extent broken down, and recently it has become clear that various ship yards are in the position to build Diesel engines, free from faults and reliable in working even with their present equipment.

Hitherto the Diesel engine has been made almost exclusively single-acting. As a rule the four-stroke cycle method has been used, but recently the two-stroke cycle has come into prominence. The efforts to utilize the Diesel engine for quite large undertakings, and finally for the propulsion of large vessels, have given an impulse to the employment of the double-acting engines both on the four-stroke and two-stroke cycles. Indeed, such progress has already been made that ultimate complete success cannot be doubted, and leading ship owners, having recognized the great value of internal combustion engines, are already one by one approaching the ship builders with their orders.

The constructor is now confronted with the task of giving to the Diesel engine the reliability in working and capacity for maneuvering which distinguish the marine steam engine, and further, in consequence of the continual decrease in boiler plant, to find gear simple enough in handling and maintenance to suit the rough requirements of a ship's auxiliaries.

The advantages of the Diesel engine for marine purposes as compared with the steam engine differ according to the type of ship and the size of the equipment, but in general the following are the most notable: The gain in useful space by the reduction of boiler plant and small size of the fuel-holders; increased capacity due to the small weight of the engine plant and the fuel; utmost utilization of the otherwise limited useful space taken for fuel bunkers; gain in time, and economy of wages, due to quicker and easier bunkering, and also to decrease in coal trimming; quicker starting of the engine; reduced and easier management; personal and space economy by reduction of the number of the stokers; reduced cost of fuel; cooler engine rooms, resulting

*Abstract translation from a paper read before the Schiffbautechnischen Gesellschaft and published in the Journal of the Society by Julius Springer, Berlin.

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in the increased mechanical capacity of the personnel, especially in hot climates; the possibility of carrying more fuel, and therefore enlarged field of action.

But the introduction of the Diesel marine engines also involves the solution of recent economic and constructional problems, of which the chief are the following: (1) The lack of suitable fuel in many harbors; (2) the lack of steam for actuating the auxiliary engines on deck and in the engine room, as well as for heating.

The engines here dealt with are the first marine Diesel engines built according to special design and put into service by a ship yard on the North Sea—J. Frerichs & Co., in Oster-Scharmbeck and Einswarden—and they form another link in the unceasing progressive development of the marine Diesel engine. They are: (1) the direct reversing four-cylinder Diesel engine of a maximum effective 200 horsepower, with 360 revolutions per minute, fitted to the service boat Frerichs, built by the above-named firm; (2) the 90 effective horsepower two-cylinder marine Diesel engine and reversing gear for driving the herring lugger Ewersand, which is employed by the Brake Herring Fishing Co., in Brake.

The Service Boat Frerichs.

This service boat is a single-screw vessel built according to the rules of the German Lloyd for small coasting traders, and has been in use since the spring of 1910. She serves for the special purpose of communication between the ship yard in Einswarden and the opposite bank of the Weser, but especially for towing. For this purpose she is equipped with a strong towing gear. The towing power amounts to about 2,200 kilos. measured on the rope. The fuel employed is the so-called gas oil, 1,000 kilos. of which are provided in two tanks under the cabin; double this quantity could, however, have been conveniently carried. These 1,000 kilos. permit of a voyage of 240 sea miles at 9.5 knots, a distance which corresponds to about the voyage from Bremerhaven to Hamburg and back.

The vessel in external appearance is like a steam tug, since she has a funnel for carrying off the gases. With a length of 18 m., she has a very spacious engine room. On deck, near the pilot house and other deck erections, is a large cabin affording room for 20 people. The existence of this roomy accommodation is due to the omission of boiler and coal bunker space. The motor, Fig. 1, is a reversing four-cylinder four-cycle engine, direct coupled to the propeller shaft; at 360 revolutions it develops 200 effective horsepower, measured on the fly wheel, and gives the ship a maximum speed of about 10 knots. Its weight is about 10,000 kilos.

The reversing gear is actuated by compressed air, abundance of which is available, which moves the horizontal cam shaft endwise, thus bringing a second set of cams into action. Starting can be made quickly and safely, and can even be effected in one second. By a special arrangement of the compressor, perfect certainty is guaranteed with regard to the starting of the engine in either direction, even in the event of the motor stopping on the dead center. The valve gear of the motor is the simplest imaginable. All the necessary movements and arrangements are combined in single mechanism. For the entire manipulation, including the regulation of the motor for high or low speed, all that is required is a single lever, which for convenience is designed as a hand wheel.

The cooling water pumps and Lenz pumps are driven by the engine crank shaft by an overhung crank, and are —see Fig. 3—fixed to the common base plate.

The hot exhaust gases are cooled with water on their discharge from the cylinder in a double-walled chamber. After their union in a collecting pipe they are conducted into a large condenser which acts the part of a silencer. From there the exhaust pipe leads into the funnel, where the exhaust gases pass into the air.

The Lenz pump provides cooling water for the exhaust. The compressed air which is required for maneuvering is generated by the motor itself by means of a two-stage compressor which constitutes, as it were, the fifth cylinder of the motor. It is received in six large receivers—Fig. 4—which are placed along the side of the engine room and made fast to the ship's side, where they take up little room. Further, a smaller air receiver is also arranged on the port side. From it the air for the injection of the fuel into the cylinder and for reversing is taken. The six large receivers serve only for starting. The air used for starting is during the voyage gradually restored again from the small supply tank. In the construction of the motor the utmost simplicity was sought, and it was especially demanded that the number of the cylinders and the movable parts should be limited as far as possible.

To start a four-cycle motor in any position at least six cylinders are required if the usual method is adopted. It was, however, desired to limit the number to four cylinders, and a way was found by making use of the compressor direct coupled to the motor. This compressor is of special design and is provided with a gear which makes it possible to use it as

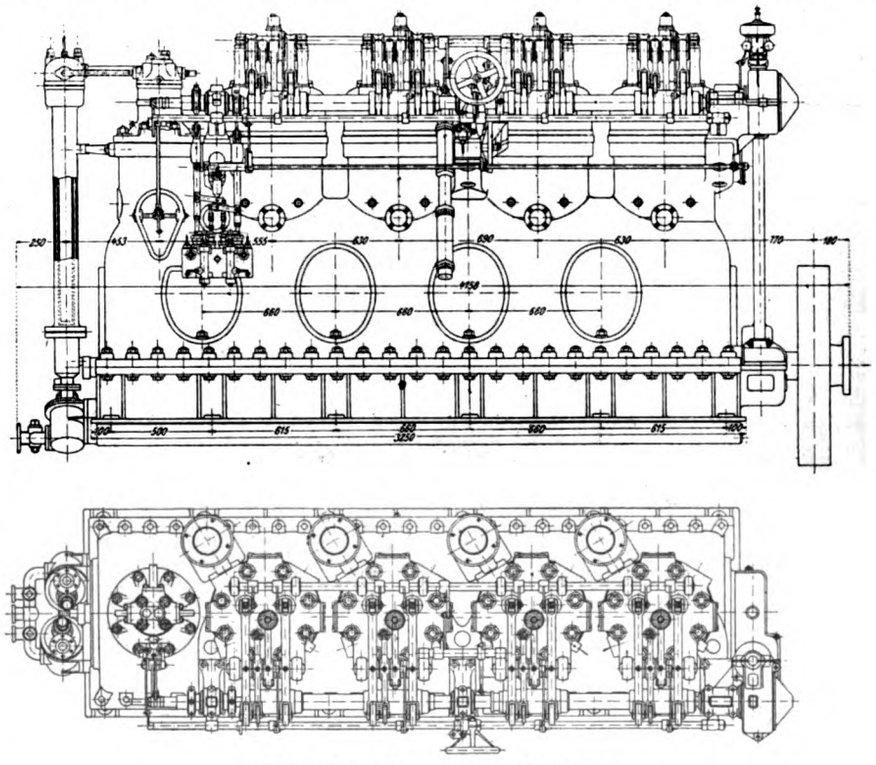

FIG. 2—ENGINES OF THE FRERICHS.

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a motive cylinder driven by the air from the receivers when the engine cylinders are not in a position to start.

It was further required that the cost of the plant should be reduced to the lowest possible amount. To this point of view the constructor cannot pay too much attention, since the cost of the Diesel engines until the most recent times has always been, comparatively speaking, very high. The base-plate of the motor is made out of cast iron and in one piece. It is closed underneath, and the separate crank pits are connected below by channels, so that the lubricating oil can flow to one end. The main bearings—Fig. 3—are recognizable as, on the whole, similar to the usual type in ship construction; the lower brass is rounded and therefore easy to remove; the upper, on the contrary, is squared. A plate of Siemens-Martin steel takes the place of the bearing cap.

The general form of the standards will be gathered from Fig. 5. It will be seen that great care has been taken to avoid sharp corners and sudden changes of form. The whole piece is a single iron casting. The lower part is semi-cylindrical above, and the ends of it are domed. The two walls are splayed outwards to the base, and pierced by large elliptical openings. The cylinder liners fit the casting as shown, and the water jacket is kept tight by a caulked leaden ring. All the jackets are in communication with each other by the passages shown in the drawing. Round cleaning holes are provided in each jacket. Between the compressor and the adjacent cylinder a square box is formed in the casting, which constitutes an intercooler for the compressor. The brackets, which support the valve shaft, are also cast on. The thickness of the casting is throughout about 20 mm.

The cylinder cover is the largest and heaviest casting in the engine, and on it are collected all the principal valves—the suction valve, the exhaust valve, the starting valve and the fuel valve. All these parts have to be got into a constricted area little bigger than the piston diameter, and yet to avoid unequal thicknesses of metal reasonable spaces must be left between the separate parts. This arrangement is also necessary to insure equal cooling, and to avoid stresses being set up by unequal heating. Furthermore, an exceedingly sound casting is absolutely essential, particularly at the joints and valve faces, and at those surfaces subjected to the high internal pressure in the cylinder or connected with the high-pressure air supply.

To carry out all these requirements presented, however, but little difficutly. As may be seen from the engraving, Fig. 6, the suction and exhaust bends are separated from the two tubes or passages which take the starting and fuel valves. The exhaust bend is entirely surrounded by water and is of such a shape as to give an easy flow to the gases. The exhaust and admission valve seat direct on the cover, for in no other way was it possible to bring them so close together. It may be objected to this arrangement that dismantling is far more difficult than when separate valve cages are employed, as it involves the removal of the whole cylinder cover, put in an engine of this size no trouble in this direction has been experienced. The only real objection is that the part of the valve spindle exposed to the hot gases may wear more rapidly than the remainder which is water cooled, but to reduce this objection the lower part of the spindle is protected by a cone from the direct impact of the hot gases. In the case of larger valves the employment of a liner is, of course, recommended. In order to make the cooling as effective as possible, the walls are made only 12 mm. thick.

From the foundryman's point of view the casting of the cover presents now no difficulty, but before the best mixture was found a considerable number were tried. In the tests the fact that only the closest and densest blends should be employed was disregarded, and it was proved that the best results were obtained with the iron in ordinary use for steam engine cylinders. All that is required is to use special care during casting and to keep the liquid iron after the mold is full in constant motion by means of a pump, to make

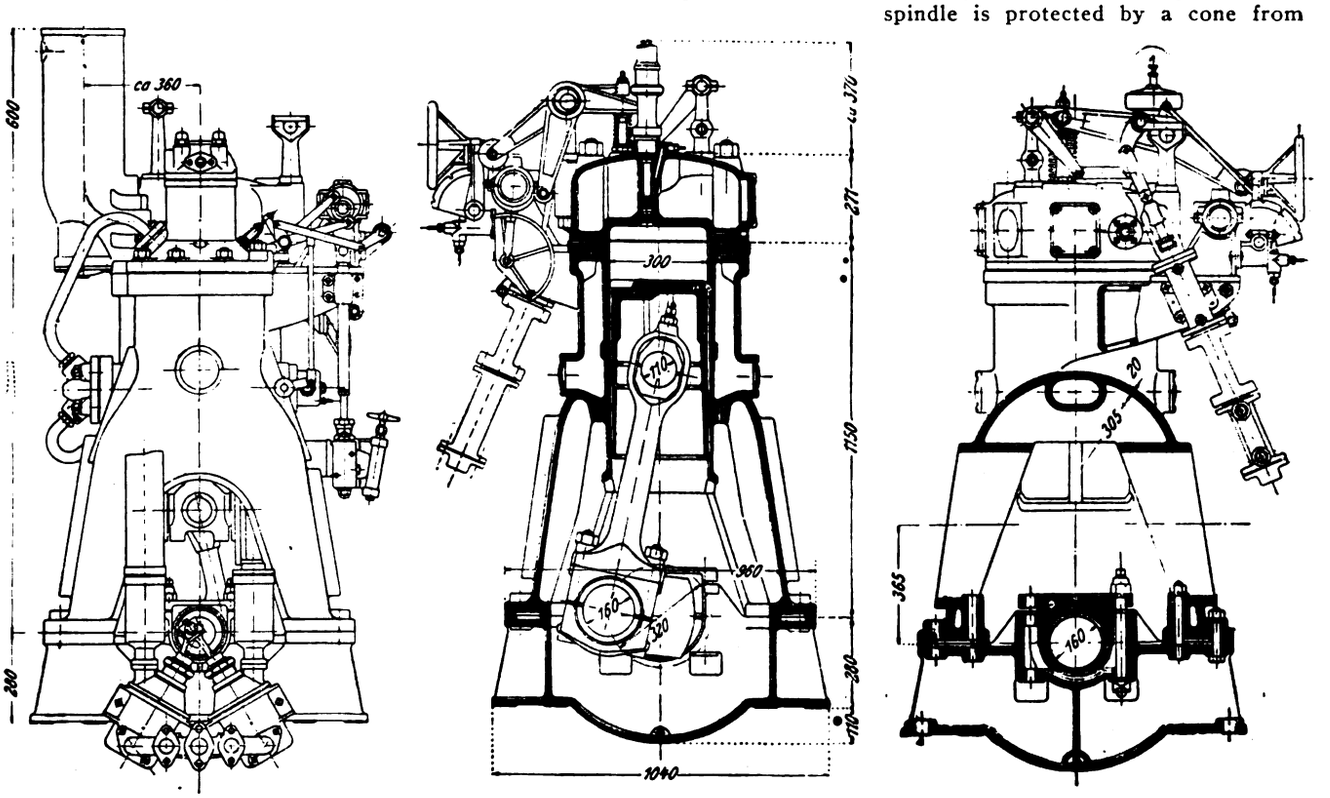

FIG. 3—END ELEVATION AND SECTIONS.

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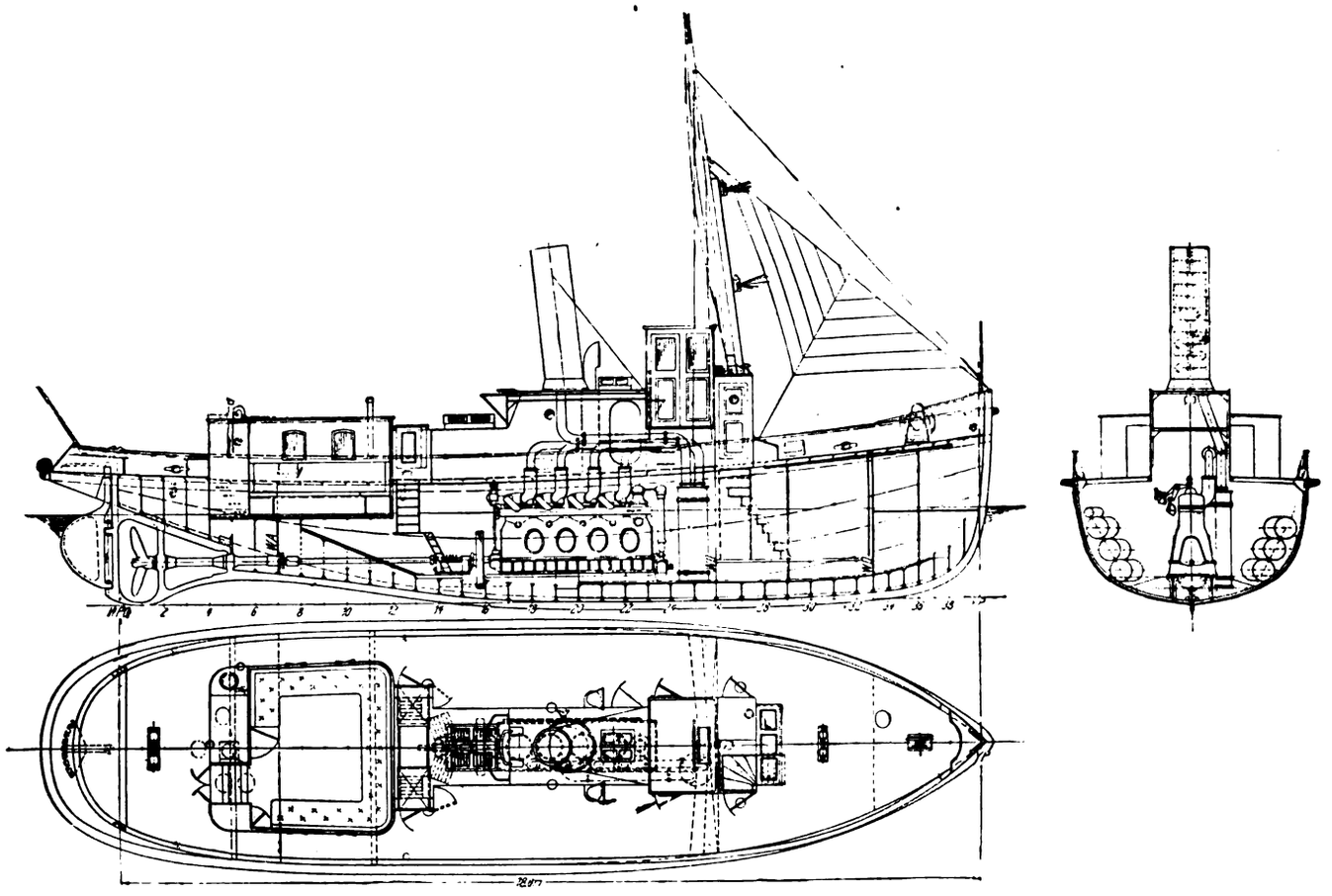

FIG. 4—THE SERVICE BOAT FRERICHS.

sure that the mold is completely filled and the iron homogeneous.

The reversing gear of this engine differs from other known designs. The principle employed is to move the valve shaft, on which two separate sets of cams are fashioned, endwise; the valve levers being raised by cams just before this movement takes place and lowered again when it is complete. These movements are effected in the following very simple way and by the use of a single hand wheel.

The shaft *a*—Fig. 8—passes over all the cylinder covers, being carried by the columns *b*, of which there are two in each cover. To this shaft are keyed the fingers *c*, one over each exhaust and suction valve, and the lever *d*, which is linked by *e* to the curved lever *f*, *f* in turn being coupled to the reversing cylinder, which has pipe connections *g* and *h* coupled to the valve box beneath the hand wheel. Here either valve can be released by the movement of the L lever *l*, which is effected by one end or other of the notched quadrant *n* coming into contact with it, this quadrant being keyed to the hand-wheel shaft. The valve being opened further movement of the plate releases the lever, and the valve again closes. Owing to the form of the quadrant *n* and the notches in the quadrant *p*, this movement can only be effected in the central position *II*. In Fig. 10 is seen a sector *T*, which is provided with a cam face which moves the lever *B*, and thus moves the reversing cam shaft *N* endways. The sector is coupled by the link shown to the

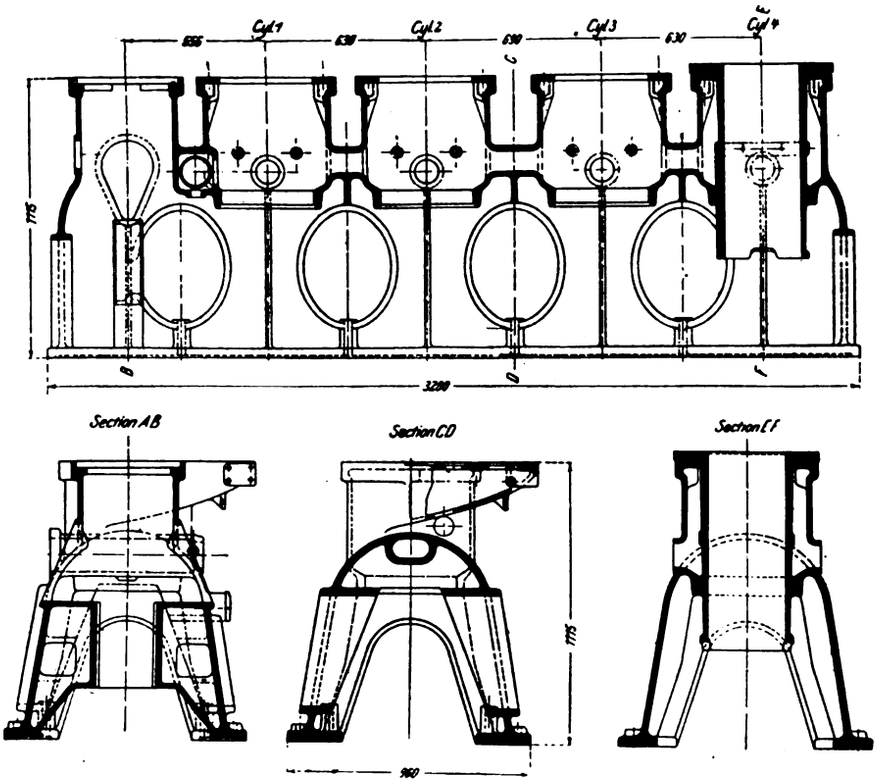

FIG. 5—CAST IRON STANDARDS.

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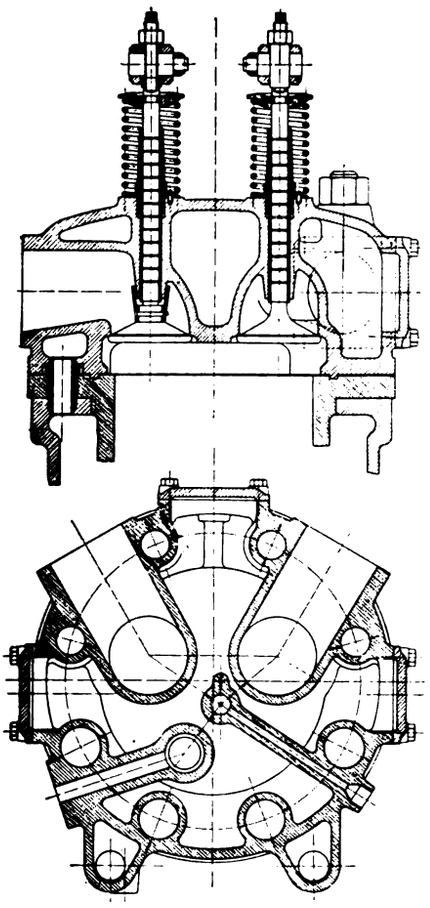

FIG. 6—CYLINDER COVER.

shaft *w*. The action of the reversing gear will now be easily understood. The hand wheel is moved to the middle position and is then revolved till the stop *r* on the notched quadrant comes against the quadrant *p* and stops further movement. During this action the valve *i* would be opened for a short time, allowing compressed air to get under the piston *k*, forcing it up. This causes movement of the linkage, and presses the valves down into the cylinder. When they have reached their lowest position the action of the cam *T* moves the cam shaft endways. By that time the piston *k* has returned to its starting position, lowering the valve rockers on to the second set of cams. The glycerine dashpot acts as a brake to prevent reversal taking place too violently. In must be added that during this process the rollers of the starting and fuel valves are lifted off their cams, and do not interfere with the motion. This is effected as seen in Fig. 7 by mounting the respective rockers on eccentrics keyed to the shaft *w*. By turning the sleeve the fuel lever moves away from its cam, whilst the starting valve lever approaches its own cam. In this position both levers are free, and the shaft can be moved endways. By further movement to the starting position, the fuel valve lever leaves its cam, whilst the starting valve lever comes into actual contact with its own. Rotation is given to the eccentric sleeve in the manner shown in Fig. 9, from which it will be seen that it is coupled by the rod *L* to the shaft *M*, to which is also keyed the hand wheel bracket *H*. This bracket with the hand wheel can be moved to three principal positions on the notched quadrant *p* — the first for running, the second neutral, and the third or lowest for starting. Further notches for half and slow speed are also provided. This control is effected by the link *d*, which acts upon the fuel pump regulator rod. As the centrifugal governor shown also acts upon this rod, an elastic coupling in the form of a flat spring *F* is provided. The governor was originally provided for the test stand, but in view of the fact that the engine might run light has been retained.

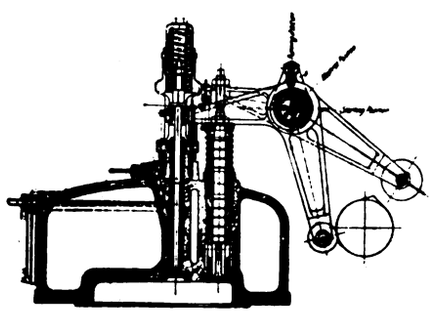

FIG. 7—AIR AND OIL VALVES AND GEAR.

It has already been pointed out that in a four-cycle engine all four cylinders might be in such a position as to render starting by compressed air in the cylinders impossible, and that therefore arrangements had been made to use the air compressor for starting under such conditions. This air pump is shown in section by Fig. 11. It is a two-stage compressor with the low-pressure stage double acting and without suction valves, air being admitted by the piston overrunning a central port. On this low-pressure cylinder are placed the starting valves *A* and *B*, operated by the cams and links shown. The compressor being double acting, it is easy to arrange that it shall start in any position which it is not possible for the power cylinders to start from. Diagrams from the compressor are given in Figs. 12 and 13, and enlarged views of the valves in Fig. 18. The fuel pump is illustrated by Fig. 17. There is one plunger to each main cylinder, but the plungers are coupled in pairs so that only two eccentrics are required. The governor already described acts, as shown in Fig. 17, upon the suction valves. The pump body is a single piece of wrought iron.

The method of constructing the valve cams is shown in Fig. 15. The exhaust and suction cams are of cast steel, and the starting cam of cast iron. By this method a small diameter of cam results, and the quietness of running is secured.

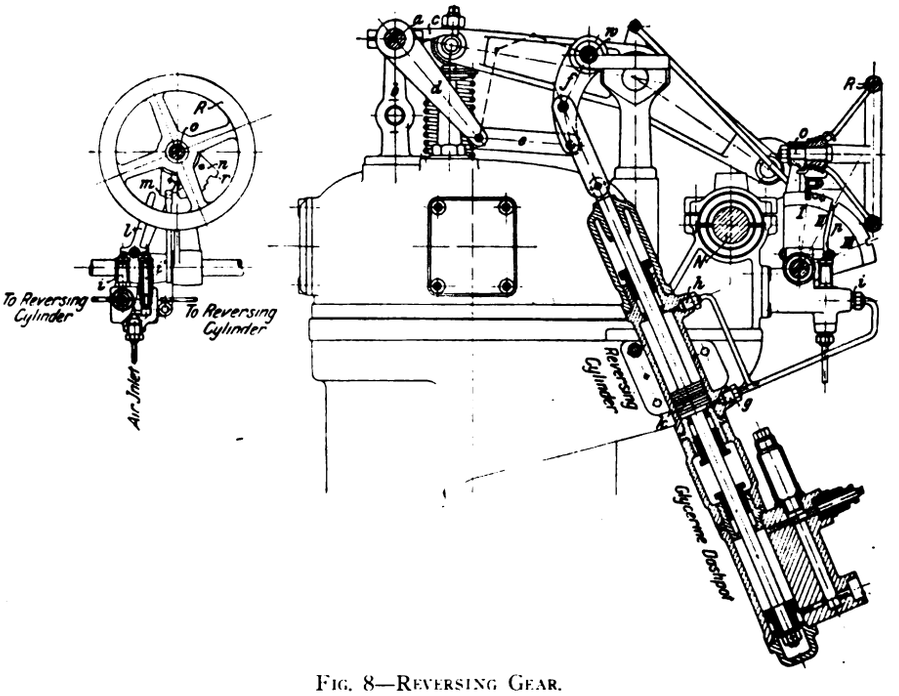

FIG. 8—REVERSING GEAR.

The lubrication of the gudgeon pin, which is always a troublesome matter, is effected in this engine by the device shown by Fig. 14. Here the tube *A* on the piston at each outward stroke is driven into oil

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contained in the cup shown, some oil enters the tube, and being retained by the little ball valve, is driven up by the next descent of the tube.

The method of driving the cam shaft is illustrated by Fig. 16. It will be seen that the arrangement permits endways movement of the shaft, whilst the long bush acts also as a thrust block.

It is not generally possible to obtain such good diagrams from high-speed as from slow-speed engines, owing to the very short space of time in which explosion has to take place, but almost ideal cards, as shown in Fig. 19, are obtained from this engine. The average pressure shown by this diagram is about eight atmospheres. The fuel consumption, measured on the test bench, amounted to between 215 and 220 grammes per effective horsepower per hour.

Practical Results.

The service boat in which the engine just described is fitted has been for a long time in regular work, and with regard to handiness fully answers all the expectations formed of her. The insurance companies have made exhaustive tests in this respect with a view to fixing the premiums payable, and have satisfied themselves that the maneuvering capacity is equivalent to that of a steamship, and they have, therefore, made the premium the same as that customary for steamships. The maximum speed of the boat can be reduced, by regulating the motor, from about 10 miles to about 3.8 miles per hour; the revolutions of the motor being lowered from 360 per minute to about 150 per minute. The lowest attainable number of revolutions is normally about 40 per cent of the maximum. The effective horsepower in this case is reduced from about 200 to 35. The speed governing of the motor can be effected either by cutting out a cylinder, releasing at the same time the fuel pump of the cylinder in question, or by regulating the supply of fuel to all the cylinders. Reversing is carried out with surprising speed and safety. Tests carried out in comparison with similar ships with steam engines have given results shown in Table I.

Thirty maneuvers can be carried out per hour without alteration of the air pressure in the starting tanks, whilst with the quantity of air stored in the starting tanks 60 consecutive maneuvers can be carried out. The starting tank holds 250 litres, and when quite exhausted it can be repumped to full pressure in 15 minutes.

The introduction of the crude oil motor, especially the Diesel motor, may be regarded as of epoch-making significance in the fishing industry. In other countries, notably in Holland and Denmark, there are already many small vessels working with motors, but Germany has only a small number to show. Generally speaking, the fishing trade in Germany in recent years can only be described as bad, and in the face of this fact the introduction of the Diesel motor today must appear especially full of promise, for it opens a new perspective to the herring fishery, and it is to be hoped will have great influence in bringing about the fulfillment of the dream that Germany's requirements in the way of herrings may be met by Germany's own fisheries. At present only a fraction of her needs is covered by her own production.

The motor lugger Ewersand, now to be described, returned at the end of October from a five weeks' fishing cruise, on which she had been

TABLE 1.

	A. Steam tug, L. 20.95 m., br. 4.86 m., d. 2.18 m. I. H. P. about 180, revs. about 185; reversing hand wheel.	B. Motor tug Frerichs, L. 18 m., br. 4.9 m., d. 2 m., I. H. P. about 185; revs. about 300; reversing hand wheel.
	Secs.	Secs.
1. Engine starts from rest, ahead, about	4-5	2-5
Engine starts from rest, astern, about	4-5	2-5
Engine reverses, from beginning of motion, full forwards to full astern	15	8
2. Beginning of ship's motion forwards from rest,	6	11
Beginning of ship's motion astern	10	12
I. Ship comes to rest from full forwards to full backwards	30	27
II. From rest to full speed astern	20	10

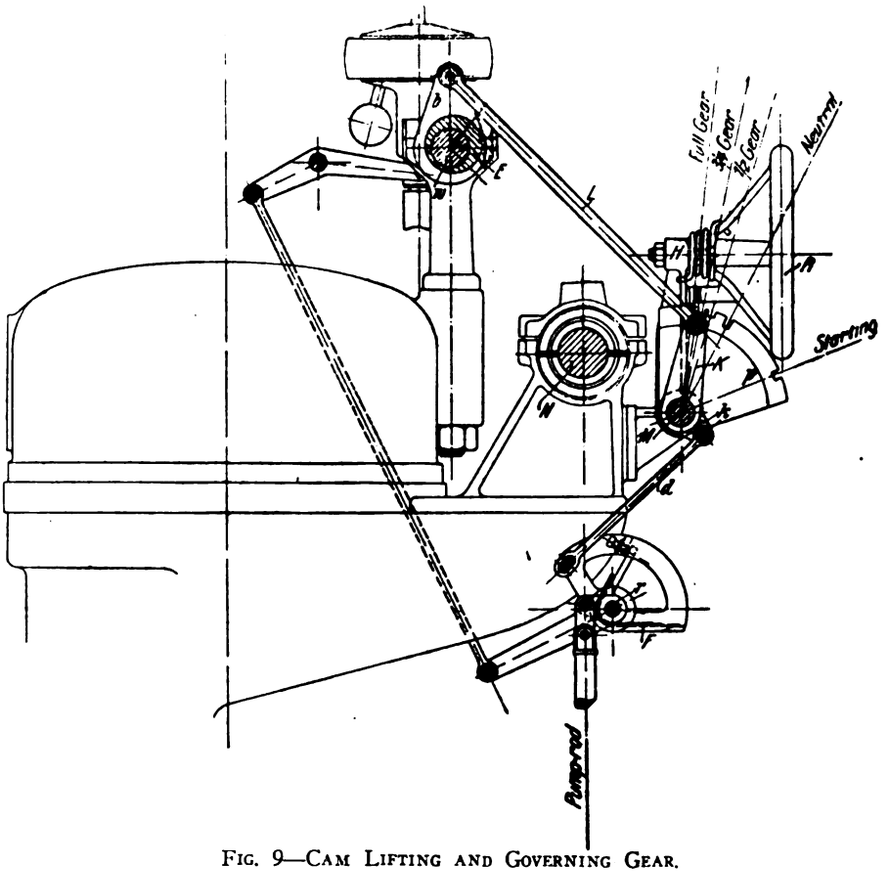

FIG. 9—CAM LIFTING AND GOVERNING GEAR.

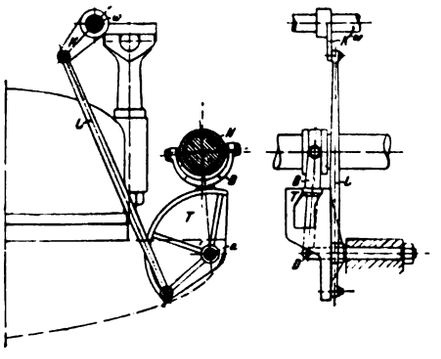

FIG. 10—CAM SHAFT GEAR.

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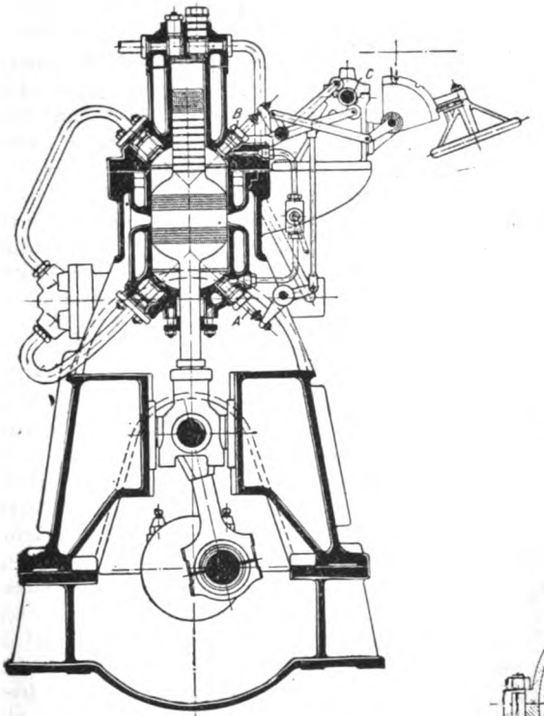


Fig. 11—AIR COMPRESSOR

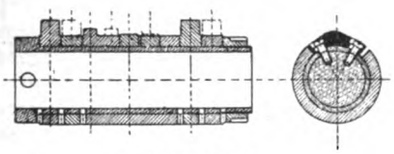
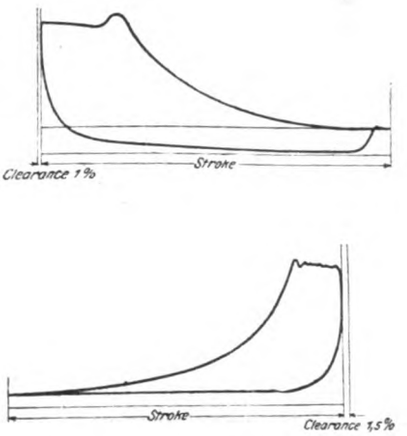


Fig. 15—VALVE CAM



Figs 12 and 13—COMPRESSOR CARDS

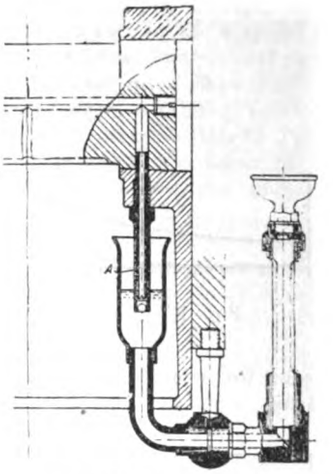


Fig 14—GUDGEON LUBRICATOR

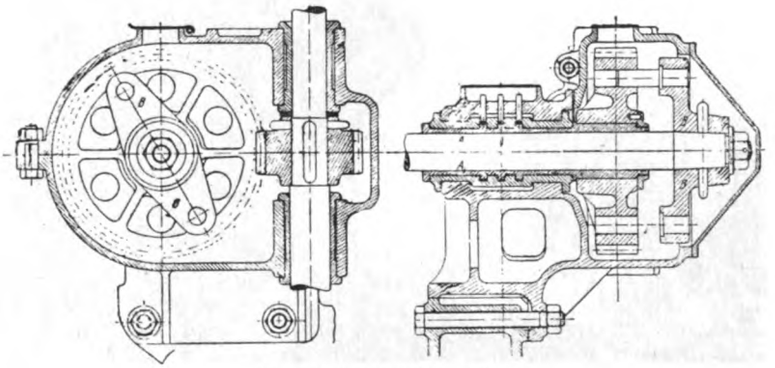
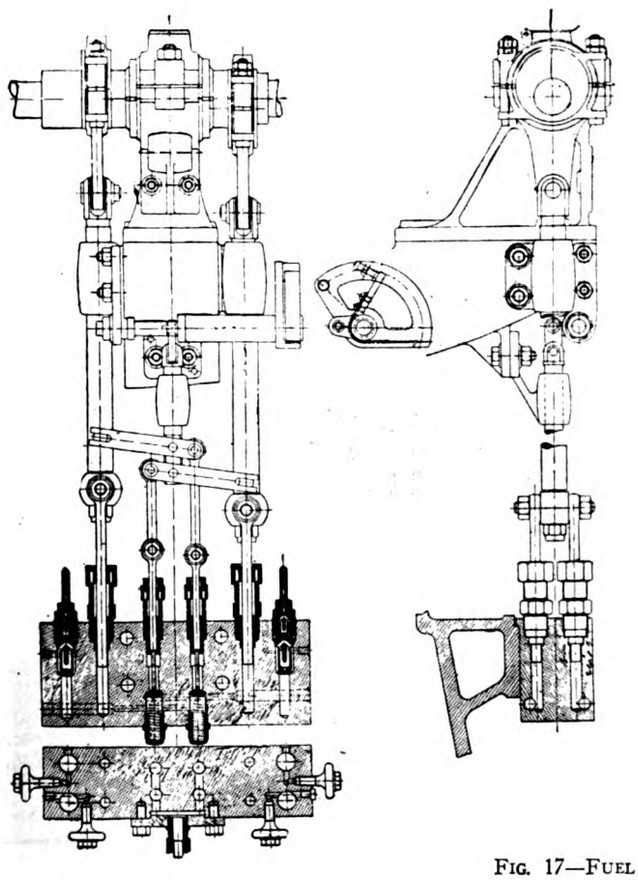
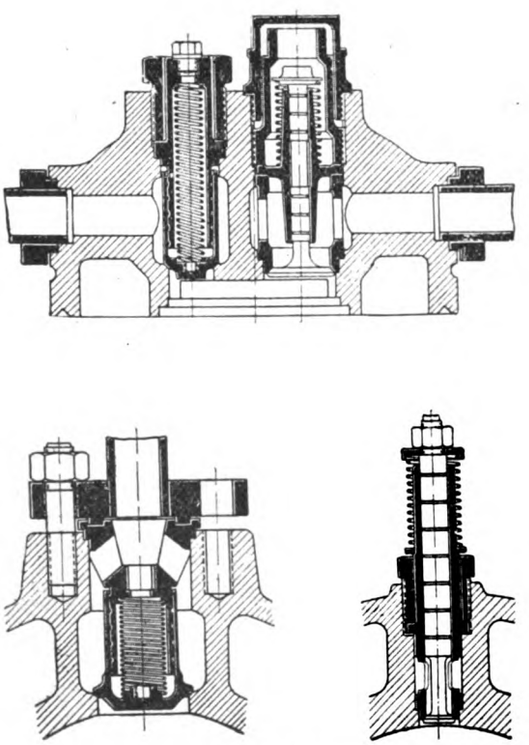


Fig. 16—CAM SHAFT DRIVING GEAR





18—COMPRESSOR VALVES

FIG. 17—FUEL PUMP.

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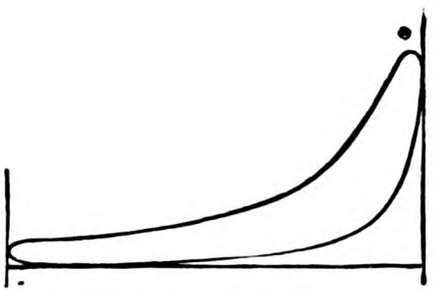

FIG. 19—ENGINE DIAGRAM.

sent for trial purposes by the Frerichs company, in conjunction with the Braker Herring Fishery, and not more than three tons of crude oil was used, whilst steam luggers on the same work used 20 tons of coal. The fuel consumption of three tons of oil can be still further reduced, since on this cruise especially bad weather prevailed, and by carelessness of the crew a portion of the oil was lost.

It was thought advisable to provide for a small auxiliary plant exactly similar to that usually employed on sailing luggers for hauling in the nets. It would have been an easy matter to haul in by the motor, but it was not considered advisable at first to have the safety of the net entirely dependent on the motor. The motor has proved itself reliable in the worst weather, and on the last return voyage from the fishing ground ran for about 75 hours in a high sea without interruption.

The fuel is stored in a fixed tank in the engine room, and takes comparatively little room in a position forward, which has not been occupied previously.

A further advantage gained from the employment of crude oil is that the cleansing of the herring casks in which, generally speaking, a part of the coal is stored, is obviated.

Trials have shown that in every respect crude oil can be relied upon for work at sea, and that, in consequence of the small space required and the low fuel consumption, there can be no doubt that it will replace steam engines for herring fishing boats.

In the construction of the motor equipment of the herring lugger, now to be described, it has again been kept in mind that everything should be as simple as possible. Above all, it was of importance, because in uncustomary work this constitutes the chief difficulty, that in bad weather extensive overhauling and repair should be rendered wholly unnecessary.

The construction of the lugger motor is, for the most part, the same as that of the service boat engine already described. A high-speed two-cylinder motor developing 80 to 90 effective horsepower with 330 revolutions is used, reversing being effected by a friction coupling and gearing. From the constructional point of view, special attention may be directed to the pedestals, and the separate cylinders—see Figs. 20 and 22. The peculiarity of the construction consists in the fact that the front column can be removed without taking the engine apart, and therefore it is possible, if required, to take out the crank shaft from the front without much trouble. Having regard to the limited space in craft of this sort, it becomes an absolute necessity that every part should be readily accessible.

With the reversing drive—Fig. 23—it is possible to carry out three different evolutions, the fly wheel revolving constantly in one direction.

(1) Friction coupling and brake blocks disengaged. The propeller shaft remains stationary. The small pair of wheels driven by the wheel keyed to the crank shaft on the large wheel on the propeller shaft, the casing and friction coupling revolving in

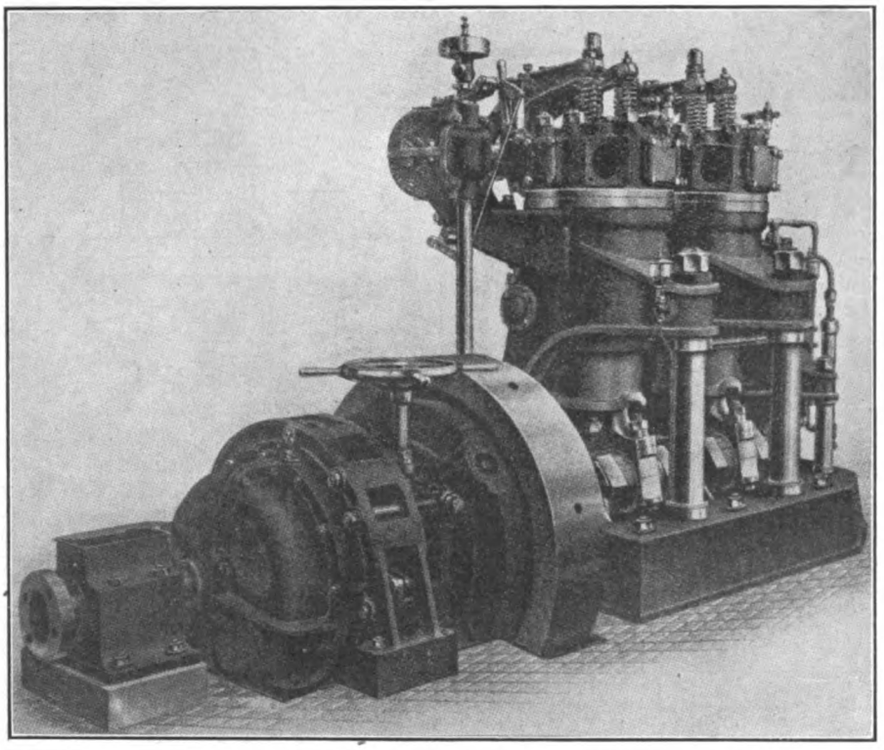

FIG. 20—90-HORSEPOWER TWO-CYLINDER ENGINE OF THE EWERSAND—FRONT.

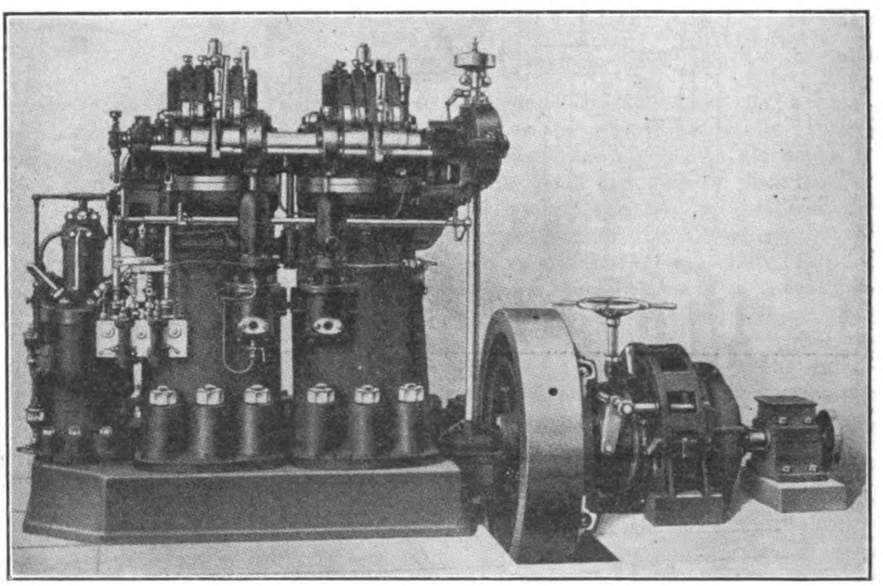

FIG. 21—ENGINE OF THE EWERSAND—BACK.

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the same direction as the fly wheel, but at half its speed. In this state the engine runs light.

(2) Ahead gear; friction coupling, and brake engaged. The fly wheel, brake ring and coupling form a rigid system with the wheel casing. The direction of rotation and number of revolutions of the propeller shaft are the same as that of the crank shaft.

(3) Astern gear; coupling thrown out of gear, brake blocks thrown into gear. In this case the wheel casing is held fast and with it the arm E. The wheels again revolve separately and the propeller shaft now revolves in a contrary direction to the crank shaft.

Reversing gears and reversing screws make exceedingy simple engine construction possible, especially the employment of a small number of cylinders, and on this account are to be specially recommended for the rough work of the fishing industry.

Comparisons.

It may now be not uninteresting to draw a few comparisons between motor and steam ships, but it stands to reason that in so doing only the most important points can be noticed, and it would not be fair to generalize from these comparisons. Such comparisons are influenced to a high degree by the size, and especially by the kind of vessel and the purpose for which she is employed. Moreover, the efficiency of the screw has to be left out of account. It is therefore only possible to show on broad lines the advantages of the Diesel engine for marine propulsion.

If the service boat above described had been fitted up for steam, an engine of only 100 indicated horsepower could have been employed, and it would have given the vessel a speed lower by about 1½ knots, and a towing power of no more than 1,320 kilos. Besides, only a short cabin could have been accommodated. In Table II are given the relative dimensions of three vessels for comparison.

I.—Motor service boat.

Ia.—Steam service boat of same dimensions and displacement as the motor service boat.

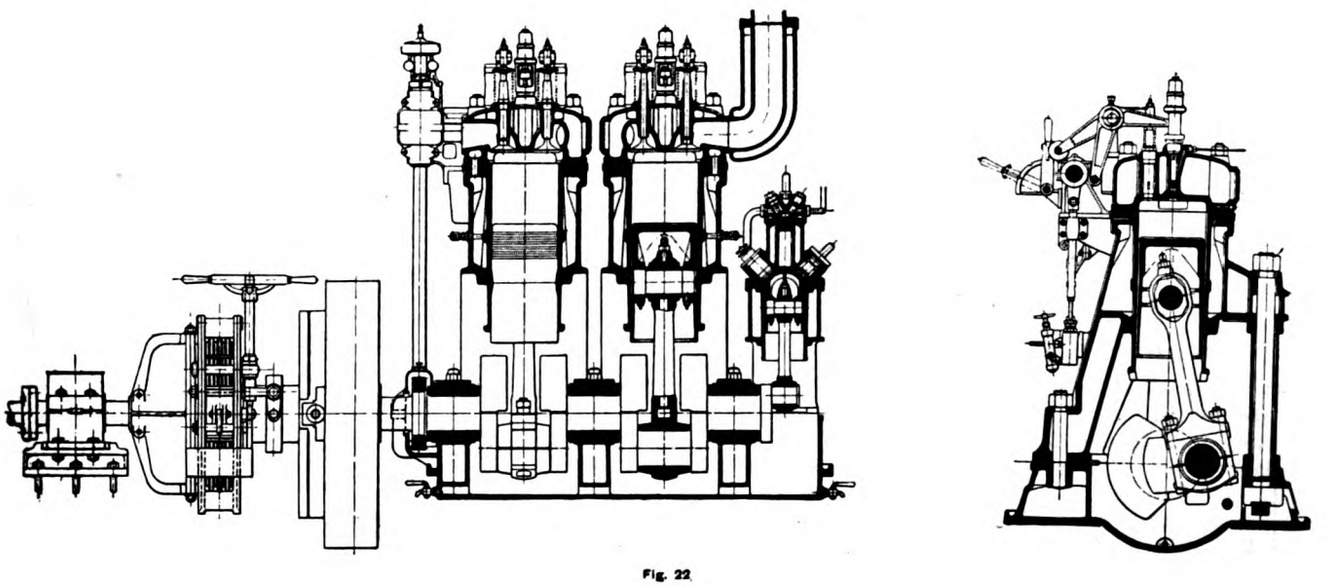

Fig. 22

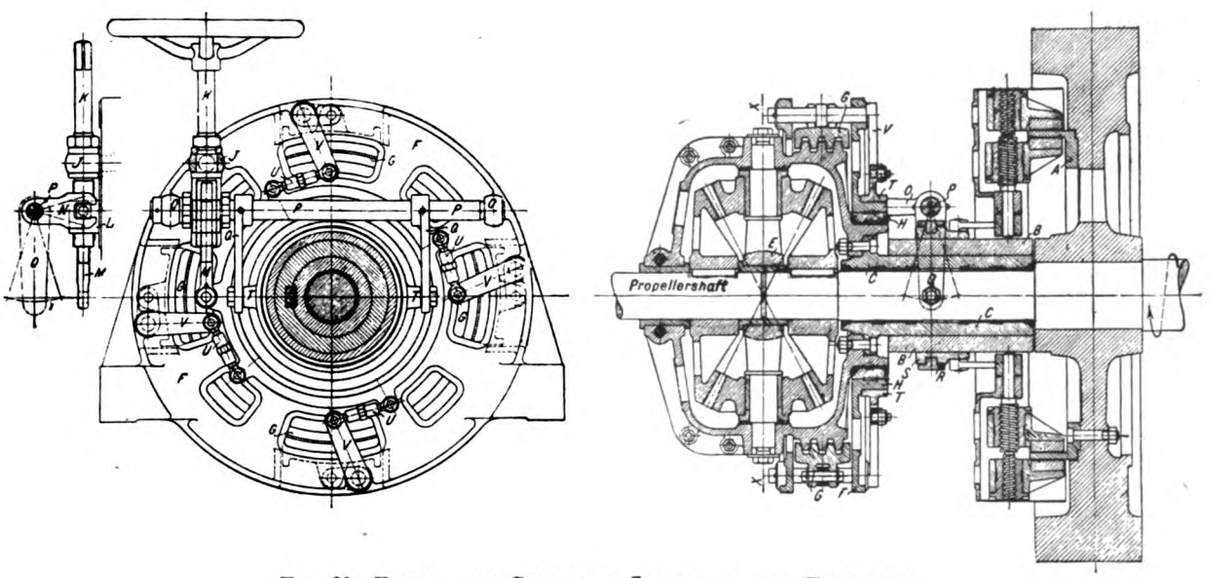

FIG. 23—ENGINE AND REVERSING CLUTCH OF THE EWERSAND.

II.—Steam service boat of the same towing power as the motor service boat.

The comparison between a steam trawler and a motor propelled trawler is even more favorable to the latter.

A motor lugger of exactly the same body plan and of the same dimensions as a steam lugger is, in consequence of the smaller space occu-

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pied by the engine and its lighter weight, in a position to take at least 160 more casks of herrings below decks than the steam lugger, and can also carry at least 30 more nets. Taking the value of the herrings at 30s per ton, the Diesel boat is able to earn about £1,125 more per year.

To this must be added a very notable economy in fuel.

For the purpose of comparison, particulars of three vessels are given in Table IV. The first is a motor fishing vessel of the small type, the second a steam vessel of the same dimensions, and the third a steam boat of larger size.

In conclusion, two cargo ships of about 5,400 tons burden—one driven by oil, the other by steam—are taken for comparison, the former being under the disadvantage that it carries its own fuel for the return voyage whilst the latter does not.

Steamer Sankaty

The steamer Sankaty left the works of the builders, the Fore River Ship Building Co., Quincy, Mass., on Wednesday, April 12, for New Bedford, where she will shortly be put into commission to serve between New Bedford, Woods Hole and Marthas Vineyard.

The Sankaty has been built to run between New Bedford, Woods Hole, Oak Bluff and Nantucket in conjunction with train service at the two first named places, and while the Sankaty will be in service all the year round, she is being constructed principally to keep open, during the rough and boisterous winter months, communication between New Bedford and Nantucket, and for this reason special care has been taken in the design to obtain a form of boat, suitable for the rough weather that will be encountered and yet be graceful in appearance and easily driven. The present fleet of New Bedford, Marthas Vineyard and Nantucket Steamboat Co. consists of four side-wheeler steamers, but in view of the winter service, for which the Sankaty has been designed and the fact that the government has recently deepened the channel at New Bedford, it was considered advisable to design the new vessel for single screw propulsion.

The Sankaty is a single-screw steamer, built to the highest class of the American Bureau of Shipping Rules and is 195 ft. long over all, 31 ft. 6 in. beam at waterline, with the sides of vessel gracefully flaring out to a breadth of 38 ft. 2 in. over guards, having a depth of 12 ft. 6 in. to main deck and when fully laden, will not exceed 9 ft. 6 in. draught. The machinery consists of a

TABLE II. SERVICE BOAT.

	I.	Ia.	II.
Vessel's dimensions, length, m.	18.00	18.00	21.50
Vessel's dimensions, beam, m.	4.90	4.90	4.90
Vessel's dimensions, depth, m.	2.50	2.50	2.60
Vessel's dimensions, draught, m.	1.90	1.90	2.00
Weight of ship equipped fully with oil or coal for 240 sea miles radius of action, tons	72.3	72.3	105.0
Normal power of engine or motor, H. P.	160	80	160
Pull on the tow-rope at 5 knots speed, kilos.	2,200	880	2,200
Radius of action in sea miles	240	240	240
Speed, without towing, about, knots.	9.5	8.0	9.5
Time for 240 sea miles at above speed without towing, hours.	25¼	30	25¼
Oil or coal consumption for 240 sea miles, say.	1,000	3,200	5,100
Oil or coal consumption for 240 sea miles, say, m.	75	58	92
Cost	£3,000	£2,500	£3,250
Steam Boat:—			
Smaller towing power than motor vessel, per cent.	60	..	..
Lower speed than motor vessel, say, per cent.	16	..	..
Loss of time in proportion to the motor vessel, per cent.	19	..	..
Greater cost than motor vessel.	..	..	£250
Greater working cost per 1,000 sea miles than motor vessel	..	..	£3 10s

TABLE III. LUGGER.

	Motor lugger.	Steam lugger.
Ship's dimensions, lengh, m.	27.36	27.36
Ship's dimensions, beam, m.	6.50	6.50
Ship's dimensions, depth, m.	3.28	3.28
Speed, say, knots	7.5	7.5
Displacement, cubic meters	254	254
Lugger on the home voyage with full equipment, but without cargo, tons	140	164
Number of fish compartments.	12	9¾
Number of casks below deck	760	600
Cargo, weight, tons	114	90
Number of nets	160	130
Average fuel consumption per voyage in kilos, say.	3,000	20,000
Average fuel consumption per voyage	£7 4s	£18
Cost without fishing equipment, say	£3,500	£3,500
Motor lugger, more casks, per cent.	160 = 21	..
Motor lugger, more nets, per cent.	30 = 18¾	..
Motor lugger, average lower working cost per voyage, say.	£13	..
Crew	Same in both cases.	

TABLE IV. FISHING BOATS.

	Motor vessel.	Steam vessel.	Steam vessel.
Length, m.	35.5	35.5	39.3
Beam, m.	6.7	6.7	7.0
Depth, m.	3.75	3.75	4.35
Motor or engines, I. H. P.	400	300	450
Speed, about, knots	11	10	11
Maximum displacement, cubic meters	400	400	550
Radius of action	The same for all three ships.		
Fuel for one voyage, about 21 days, kilos.	32,000	100,000	150,000
Fuel, cost	£76 15s	£90	£135
Fish and ice capacity, cubic meters.	165	115*	165*
Fish and ice tonnage	135	94	135
Crew, men	12	10	14
Cost	£8,000	£7,000	£9,650

*Including reserve bunker.

TABLE V. CARGO VESSELS.

Type of ship.	Motor.	Steam.
Dimensions, length, m.	103	103
Dimensions, beam, m.	14.6	14.6
Dimensions, depth, m.	9.6	9.6
Dimensions, draught, m.	6.55	6.55
Dimensions, coefficient of displacement	0.78	0.78
Effective H. P., taking mechanical efficiency at 90 per cent.	1,350	1,500
Gross tonnage	5,550	5,490
Fuel (double voyage for motor ship, single voyage for steamship) tons	350	480
Carrying capacity, tons	5,200	4,920
Advantages in favor of motor vessel	280 tons.	
Speed, knots	10	10
Fuel consumption (0.226 kilo. E. H. P.; 0.550 kilo I. H. P.) daily, tons	7.13	19.8
	£ s d	£ s d
Fuel cost (£1 14s for oil; 15s 8½d for coal) daily.	12 2 0	15 11 0
Advantage of the motor ship, daily.	3 9 0	
Crew— 1 first engineer, £15 per month	15 0 0	15 0 0
1 second engineer, £9 per month	9 0 0	9 0 0
1 third engineer, £5 per month	5 0 0	5 0 0
1 engineer's assistant, £3 per month	.....	3 0 0
1 fitter, £5 per month	5 0 0	.....
6 stokers and trimmers	.....	22 10 0
2 greasers at £3 15s	7 10 0	.....
Keep, 1s 2½d per man daily	10 16 0	18 0 0
Total wages and keep	52 6 0	72 10 0
Advantage of the motor vessel per month.	20 4 0	.....
Saving yearly, i. e., for four single voyages at 40 steaming days:—		
		£ s d
(1) More earned in freight, 16s per ton for full voyage, to and fro.		896 0 0
(2) Fuel, 160 × £3 9s.		552 0 0
(3) Wages of crew, 404 × 12s		242 8 0
		1,690 8 0
(4) Interest on greater cost of motor equipment.		125 0 0
Yearly saving		1,565 8 0

(This may, perhaps, be somewhat reduced in consequence of the probable increase in lubricating oil required and of the higher cost of upkeep.)

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triple expansion engine with cylinders 16 x 25 x 42 x 27 in. stroke turning an 8-ft. diameter, cast iron, four-bladed propeller at 150 revolutions per minute. Steam is supplied from four Almy boilers, having a total grate surface of 161.5 sq. ft. and a total heating surface of 6,212 sq. ft., which will give an estimated sea speed of between 14 and 15 statute miles per hour. Special precautions have been adopted in the design against loss of the vessel by collision or foundering and for the safety of passengers from fire, etc., the boat being divided longitudinally into seven watertight compartments.

The Sankaty is graceful and well balanced in appearance, having a straight stem and modified tow-boat stern, two stacks and two pole masts, whereon arrangements have been made for the installation of a wireless outfit at a later date, should it be found that the needs of the service demand it.

The crew is berthed on the lower deck forward, while the officers' and crews' dining rooms and galley are located on the lower deck aft. The midship and forward ends of main deck are arranged for the carriage of freight and automobiles, while at the after end of this deck is located the social hall and gentlemen's lavatories. The saloon deck above is given over entirely for the accommodation of passengers, special arrangements having been also provided for privacy in the fitting of two staterooms and six day cabins. At the after end of the saloon deck house is the ladies' parlor and retiring room, entirely separated from the main saloon, while the ends of the deck, outside of the house, have been left clear and unobstructed for use as a promenade for passengers. On the hurricane deck, which is also for passengers' use, are located the pilot house and captain's and mate's staterooms, together with four 24-ft. metal life boats, two life rafts and a 16-ft. working boat.

Isherwood System of Construction

By Robert Curr.

FIG. 1 shows the midship section of a derrick barge, 50 ft. x 20 ft. x 5 ft., constructed on the Isherwood system.

On this section, *A* shows the floor plate, which is 12 in. x 10.2 lb., and flanged on the top to form a reverse angle.

The angles connecting the shell plating and transverses together are 2½ in. x 2½ in. x 4.1 lbs.

At the notches a clip is riveted on the floor, which stiffens the floor and forms a connection for the longitudinal frame to be riveted to. *B* shows the side or vertical part of the transverse, which is similar to the floor.

One longitudinal frame passes through the transverse at the side.

C, the beam part of the transverse, is similar to the bottom, only being the round of the deck deeper at the center than the floor.

As will be seen, this transverse forms a belt around the plating and may be considered the nearest approach to a continuous member across ships.

These transverses in this instance are spaced 5 ft. apart and connected together with ⅝-in. diameter rivets.

The rivets connecting the plates at the corners are equal to the area of section of the plating.

Two oak fenders, 6 in. x 6 in., fastened to 3-in. x 2½-in. x 4.9-lb. angles, are continued all around the vessel.

Longitudinal Frames.

The longitudinal frames are spaced 24 in. apart in the bottom and deck and 30 in. at the side.

These longitudinals are 3-in. x 2½-in. x 4.9-lb. angles and in one piece the whole length of the vessel, as shown by Figs. 2 and 3.

The longitudinal plan, Fig. 2, shows the frames running from end to end and the nine tranverses on same.

This side elevation shows only the one frame, which is connected to the cross angle on the bulkhead with a plate bracket forming a belt around the vessel. The ending of the longitudinals is shown in Fig. 4.

Fig. 3 shows the deck framing as well as the transverses.

The bottom is similar to the top with one exception, as shown by midship section, Fig. 7.

The corner angles on the deck have the flanges extending over the side and

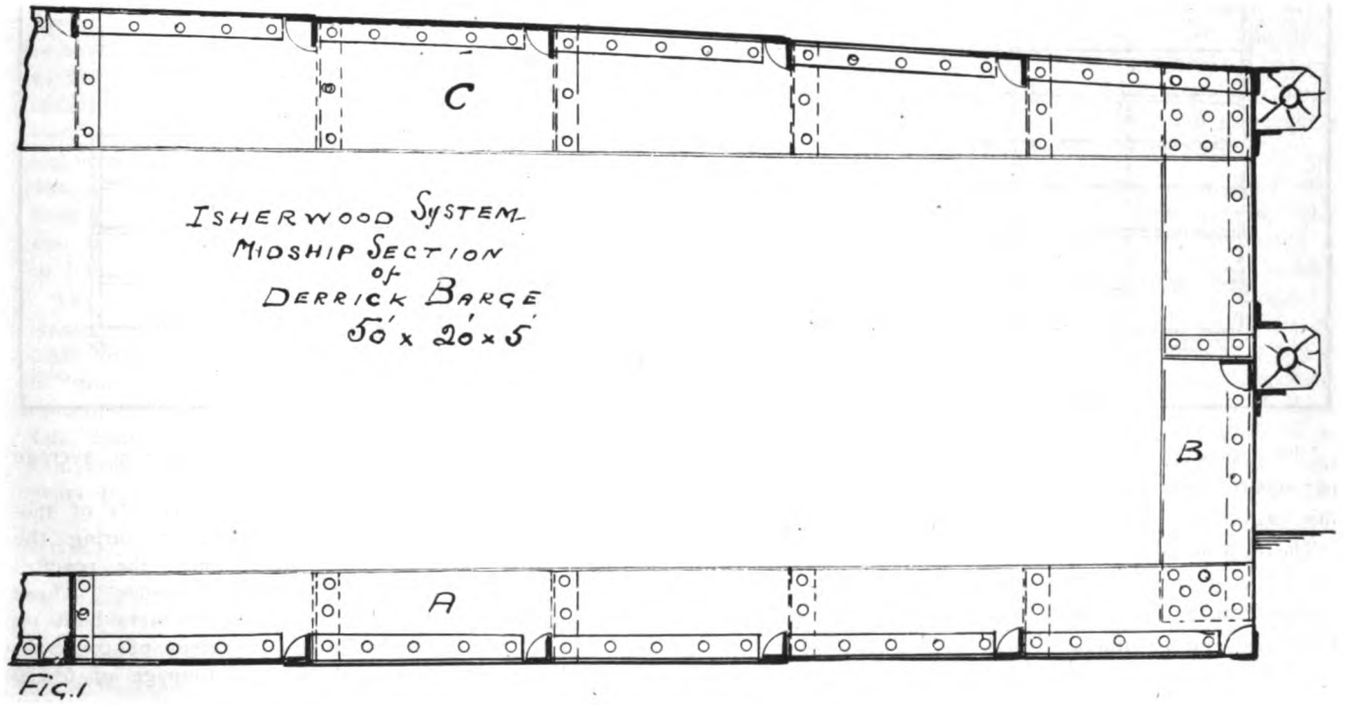

FIG. 1

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the deck plating riveted to same.

This forms a flange for the oak fender, which is bolted to same.

The corners on the bottom have the bosom of the angles fitted to the plating, which is considered a good idea for corner fastening.

The corner angle, arranged in this way, does not save any work, but it leaves the plating less liable to spring away from the rivets in case of the barge touching bottom or docks.

Fig. 4 shows clearly the ending of the longitudinals, which are riveted top and bottom to 12-in. x 10.2-lb. flanged plates with a number of rivets equal to the area of section of the longitudinals.

The cross angle on this bulkhead is shown connected to the side longitudinal with a plate bracket.

The plating on this bulkhead is removed to show the interior arrangement of the vessel.

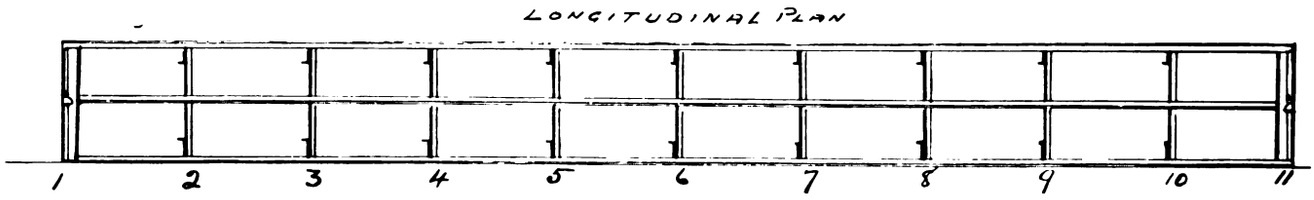

FIG. 2

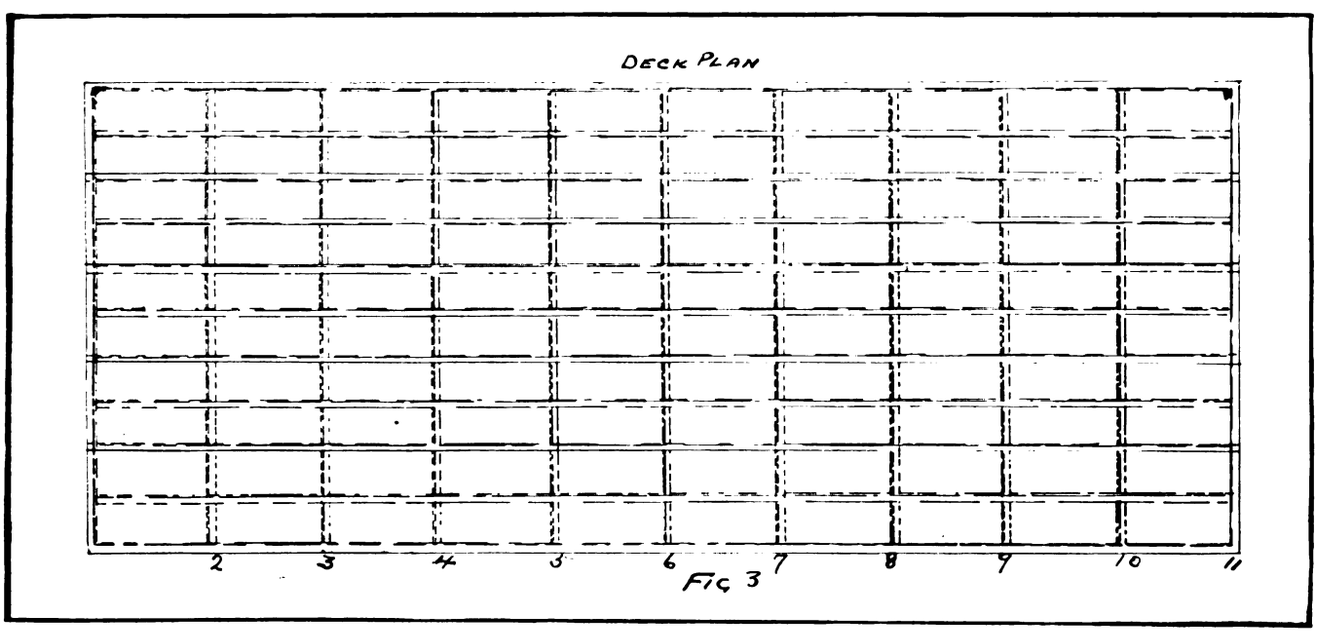

FIG 3

The plating of this vessel is 10.2 lbs. per square foot all over and lapped on the longitudinal frames.

The principal advantage to be gained on this construction is the arrangement of the framing which forms trusses both transverse and lengthwise.

There is a saving of a possible 10 per cent of materials and easier construction compared to the cross framing.

Mr. Isherwood slightly changes the terms of the framing.

He names the cross frames "transverses" and the angles running lengthwise, "frames".

In the old terms, the frame of a metal ship was composed of three parts, viz.: The floor, angle frame and reverse frame.

In Mr. Isherwood's arrangement the transverse is composed of floor, vertical and beam and the longitudinal simply the section it is composed of and may be considered one piece.

When the longitudinal frames have a long span and not easily handled, a butt strap is used and a connection made of the same material with a number of rivets equal to the frame itself.

The simplicity in this construction is more noticeable in the ship shape vessel, seeing it is constructed with less cross frames than in the ordinary method of construction.

This construction is new and, like all new ideas, is slow in making progress at first.

The Isherwood system is spoken very favorably of, in all ship building districts.

Ship Building Under Lloyds Register

During 1910, 583 new vessels of 1,057,428 tons, have been classed by Lloyds Register. Of these vessels, 517 of 1,055,289 tons are steamers, and 66 of 2,139 tons are sailing vessels.

With the exception of 65 small wood vessels of 1,039 tons, the material used in the construction of the whole of the tonnage classed was steel.

Sailing tonnage, which formed 25 per cent of the total tonnage classed in 1891 and 30 per cent in 1892, has since steadily decreased; the output during 1910 is, in fact, the smallest sailing tonnage ever classed in one single year by the society. The percentage of sailing tonnage to the total tonnage classed for 1910 is 0.2 as against 1.4 for 1909. For the five years, 1904-1908, the yearly average was 0.77 per cent.

A large number of vessels of special type were classed during the year, designed to meet the requirements of particular trades. These comprised eighteen steamers built on the longitudinal system of construction, with a total tonnage of 65,550

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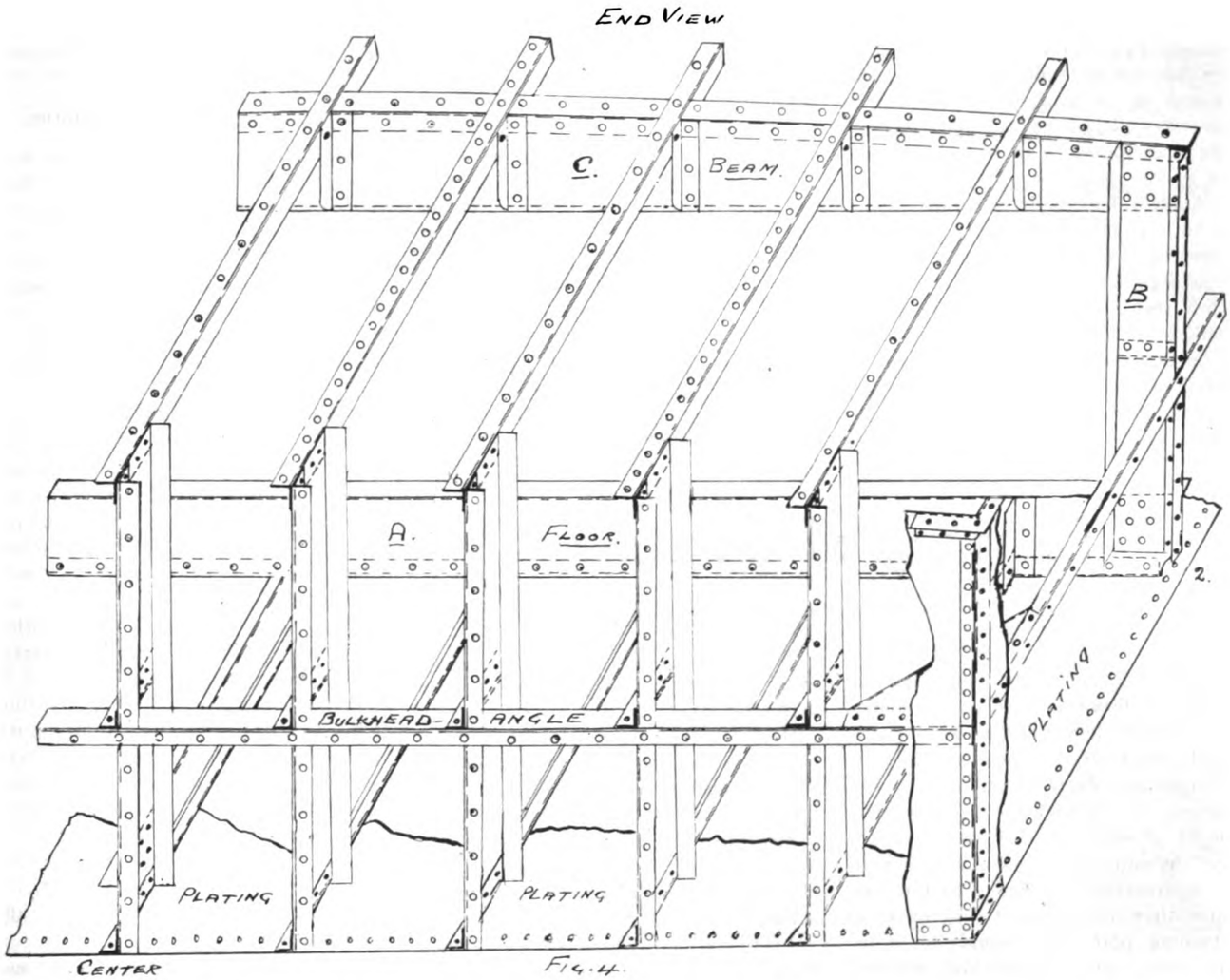

FIG. 4.

tons, including one built for carrying two steamers intended for channel and oil in bulk; five other steamers of 21,798 tons, also for oil in bulk; twenty-coasting purposes; five steamers of the wing and side tanks type; three steamers for the Canadian lakes; together with numerous vessels of other special types, such as yachts, dredgers, river steamers and barges, tugs, fishing vessels, and ferry boats, as well as one steamer, the Vulcanus, of 1,179 tons gross, fitted with an oil engine, and intended for carrying petroleum in bulk.

The average size of the steamers classed during the past year is about 2,041 tons. Excluding vessels under 500 tons, in order to avoid the diminution caused by small coasting vessels, fishing vessels, yachts, etc., the comparative averages for the past few years stand as follows:

	Steam.		Steam.
1910.....	3,341	1909.....	3,007
1908.....	3,308	1907.....	3,383
1906.....	3,356	1905.....	3,334
1904.....	2,940	1903.....	3,116
1902.....	3,246	1901.....	3,176

During 1910, twenty-eight steamers of over 7,000 tons each have been classed, as compared with seventeen in 1909, seventeen in 1908, eight in 1907, twelve in 1906, fourteen in 1905, and fifteen in 1904. Two of the steamers classed during 1910 were over 13,000 tons each, namely, the Balmoral Castle and the Edinburgh Castle.

Of the tonnage classed during the year, 873,982 tons, or about 82 2/3 per cent, have been built in the United Kingdom. Among foreign countries, Germany contributed the largest amount of tonnage (eight steamers of 40,182 tons), then follow the United States (37,874 tons), Japan (27,591 tons), Holland (25,450 tons), and Austria-Hungary (18,473 tons).

This return includes a statement showing the countries for which the tonnage that has been classed was built. The tonnage built for the United Kingdom was 754,625 tons, and 302,803 tons for other countries. Among the latter Germany leads with 50,802 tons; then follow: The United States with 37,874 tons; British colonies, 32,866 tons; Holland, 29,172 tons; Japan 28,164 tons; and Austria-Hungary, 27,705 tons.

New Steamer Sioux

The Moran Co., at Seattle, has just completed a new steamship for the Puget Sound Navigation Co., which will be one of the finest of her class on the North Pacific coast and which has many novel features incorporated in the construction of her hull and passenger accommodation.

The steamer, which has been named the Sioux, and which will be run in the Seattle-Irondale-Port Townsend service, is a single screw steel vessel of the following dimensions: Length, 150 ft.; beam, 24 ft., and depth to main deck, 8 ft. The propelling machinery consists of one balanced four-cylinder, triple-expansion engine with independent auxiliaries, steam supplied by two Seabury water-tube boilers with equipment for burning fuel oil. On her trial trip she made a speed of 15 knots, which is considered extraordinary speed to be attained by a steamer of that size.

The Sioux presents a new idea in steamship construction in Puget Sound waters. The house on the upper deck is carried out to the sides of the vessel

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and is constructed of steel. She is the first passenger craft in these waters to have her cabins built up in this manner and as no space is wasted in passage ways along the rail the house is large and roomy. Another novel feature is the space for passengers aft of the house. This is so arranged that it can be left open in good weather and in stormy or rainy weather can be enclosed by fitting in portable windows, observation style, and producing a sort of vestibule effect.

The interior of the passenger accommodations is finished in mahogany worked in panels between and below the windows. No state rooms are provided for passengers. The dining saloon is on the main deck and will seat 24 persons, and the smoking room and bar are on the main deck forward. The Sioux is built of steel up to her hurricane deck and is fireproofed as far as possible. Considerable of the steel used in her was manufactured at the Irondale plant of the Western Steel Corporation. She will be a factor in building up this new steel town on the sound and will afford the residents on that end of the waterway an excellent means of transportation to the larger cities. The vessel is fully equipped in accordance with the United States steamboat inspection laws for ocean-going service.

Shaping of Courses

By Frank Henrich.

WITH the increased length and size of steamers the shaping of courses can no longer be done by rough and tumble methods, but becomes a strict mathematical demonstration, and considering the fact that these steamers can be steered with greater accuracy than the old short boats, it is a matter of greatest importance to the navigator that, when shaping a course at a turning point, he should know before hand, with reasonable certainty and confidence in his own calculations, how his steamer is going to pass the next place where a change of course is demanded. This is the proper method to follow and, if the ship does not exactly make good, to carefully inquire into the causes of the aberration.

The vicious method, which unfortunately is mostly used, is to take the log book and inquire for the course steered the last time when in the same position, then shape the course accordingly; now, with the usual conditions of difference in cargo and trim, there exists absolutely no reason why the course which made the ship come out right on former occasions, should again answer; from hard and often very costly experience it is found that this is not the case. It follows that at every turn the ship's course should be checked, by azimuths when available, and from other practical sources such as ranges or landmarks.

"Every deviation from the proper course, every stranding constitutes a mute acknowledgment on the part of the navigator, that he is unable to cope with known factor of disturbance, of which ample warning has been given.

If a steamer does not make good her course as given by the navigator, the conclusion to be drawn by impartial judges must be that the navigator is devoid of the elementary knowledge of navigation, or is too careless to observe proper precaution against accident.

To those who, whenever approached about pelorus work, say: "In clear weather we do not need it, in foggy or bad weather the method is not available," the answer is the same as that which applies to many other conditions on board ship. Take the greatest care to ascertain the error and working of the compasses in fine weather, then, in contrary weather there will be no trouble in shaping a safe and reliable course. In other words, if at all times, whenever available, the compasses are checked by the pelorus, a satisfactory course can be shaped, protecting lives and property when absolutely no check can be found.

Attention is invited to night observations, for, as courses have to be altered by night as well as by day, it appears obvious that every navigator should be competent to use the moon and stars for observation, which knowledge is easily acquired.

Lecky, in his Wrinkles, says: "Remember: That however well a compass may be adjusted, observation for deviation should be made every watch as a matter of ordinary routine. Special observations should be made after any change of course exceeding one point. It is not possible to compensate for retained magnetism, and in some ships the deviation from this cause is very large."

Night Observations by Pelorus.

The owners furnish every ship with a pelorus and the necessary auxiliaries, such as azimuth tables, nautical almanacs, etc., and therefore have a good reason for assuming that all the means will be used for safeguarding their interests, not only from keeping the ship from the rocks, but also to make the most direct course between ports. You all use the pelorus during the day time when the sun is available for the purpose of finding the error of the compass and the proper course to be steered. I wish to impress on your mind that this is not sufficient, that a pelorus is put on board to be used by night as well, whenever any celestial objects are available for observation. In other words, if a pelorus is made to serve in daylight only, you neglect fully 50 per cent of your resources of time alone, and as far as opportunity goes, considering the multitude of objects, the moon, the four principal planets and a host of stars, each and every one your servants for this work, you must be aware that you are wasting away the largest percentage of the usefulness of your instruments, and opportunities.

If a direction is obtained from two or more stars by the pelorus this course is incontestable and will bring you through to your destination without any shade of doubt. But aside from this, there are other useful things to be obtained from night observations without the use of the pelorus. No doubt you have witnessed at all times of the night, that stars cross the ship's head on their diurnal journey across the sky, from north to south when you are steering east, and from south to north when you are steering west. Now when the object is right ahead, you can calculate its true bearing from the tables and thus obtain the magnetic bearing by applying the variation, and reading both compasses you ascertain the error of both, and have not left the pilot house nor used a pelorus and have the deviation within a tenth part of a degree.

Again the pelorus: In order to be at all times prepared to do efficient work, the mates should be made to check all the ranges when passing through the rivers by pelorus and azimuths of the sun. It is evident that when a steamer is heading exactly on a range the pelorus must show

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the range with the same precision, or else something is wrong either in the position or construction of the pelorus or in the calculation of the observer. Again if the pelorus does not check up with the ranges, how do you expect to shape a reliable course, when away from these means of verification? This work is of vastly more importance than the scrubbing, painting and bossing of deckhands which the mates are generally busy with when in the rivers. Remember the navigation and consequently the safety of the ship comes first, everything else is secondary. There is nothing like this work to give confidence in pelorus work to those unaccustomed to it, because they know what they should obtain, and any little error which may creep in, will immediately show.

Retained Magnetism.

It is an acknowledged fact and constitutes a theorem in magnetism, that the earth's magnetic force is always at work, not only in holding the compass needles in certain direction, but also in causing induction on the iron and steel of which the ship is constructed. This is made apparent, when a steamer is moored to a dock for a length of time. On leaving the north end of the compass needle develops a tendency to hang to the direction in which the ship pointed when so moored.

The maximum disturbance will be found at right angles on both sides of the direction. To illustrate: If a steamer is lying at a dock in a south direction for several days, when proceeding to the next destination, attempts to make good a westerly course, there will be found, owing to retained magnetism, a westerly deviation which did not formerly exist. If we assume this disturbance as ½ point, we have to steer W. ½ N to make good the required course; or, if endeavoring to make good an easterly course, we must steer E. ½ N. to compensate for the error.

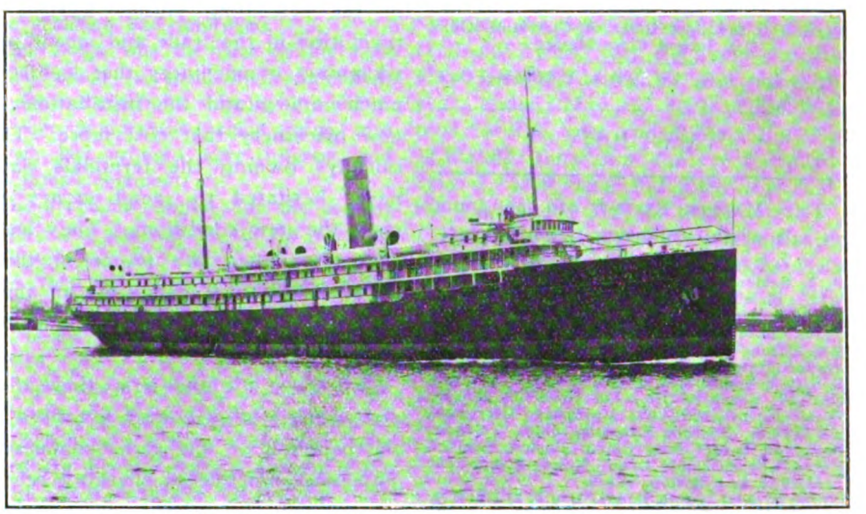
This error is temporary, diminishes, and finally disappears with time more or less rapidly, in direct proportion to the magnitude thereof. A partial remedy at hand is to turn the ship under starboard and port wheel each clear around. This diminishes the error and in some cases entirely obliterates same. The adjuster cannot compensate for this kind of disturbance, therefore the navigator must be prepared to allow for the error.

There is an exception to this condition. When a steamer, while moored to a dock, heads in the direction which she occupied while building, no disturbance will be caused, only a change in the dynamic force of the compass needle which does not affect the deviation. It follows, that it is of greatest importance to know this direction, which should be recorded in the ship's log, as the magnetic character of the ship, acquired during the process of building, does not change materially, of which we have innumerable examples.

Steamer Somerset

The steamer Somerset, which was built for the Merchants' & Miners' Transportation Co. by the New York Ship Building Co., Camden, N. J., underwent her four-hour official trial on the Delaware river, last month, quite successfully. She was launched March 30, and her dimensions are: Length, 333 ft.; width, 46 ft.; depth, 30 ft. She is designed for passenger and freight service and is to be used in the Baltimore and Jacksonville service.

Miss Constance Zerrahn, daughter of Mr. and Mrs. Zerrahn,, of Matapan, Mass., and a niece of Ellerton P. Whitney, vice president of the Merchants' & Miners' Transportation Co., was the sponsor.



S. S. SOMERSET.

Trial of Torpedo Boat Destroyer Ammen

The United States torpedo boat destroyer Ammen, which was built by the New York Ship Building Co., Camden, N. J., is now on her trial trip off the Delaware breakwater course. On her standardization trials today her time was 33.35 knots per hour; her contract calls for 29½ knots per hour. The boat has a length over all of 293 ft. 10½ in.; breadth is 27 ft., and her displacement is 742 tons; her draught about 8 ft. 4 in., using oil for fuel. She was launched on Sept. 20, 1910, Miss Ethel C. Andrews being sponsor, daughter of the general manager, George M. Andrews.

Valve Gear on Steamer Oklahoma

Luther D. Lovekin, chief engineer of the New York Ship Building Co., recently received a letter from the J. M. Guffey Petroleum Co., indicating the exceptionally good working of the valve gear on its steamer Oklahoma, fitted with Lovekin automatic assistant cylinders for valve gears. The letter is as follows:

Port Arthur, Texas, Jan. 5. Examined piston valves on main engine and found same down as follows:

H. P. down 5-64ths.
I. P. down 3-32nds.
L. P. down 5-64ths.

The above includes all wear on saddle blocks, fork end brasses on eccentric rods and eccentric straps. Liners were put under foot of eccentric rods to bring valves up to original position.

This is the first time that any adjustment has been made to valves since the ship left the ship yard. The ship has been in commission two years and eight months and has traveled 152,400 miles.

H. J. Pauly, Milwaukee, Wis., has sold the steamer Harlem to the Chicago & Duluth Transportation Co. She will be converted into a passenger boat at the yard of the Manitowoc Ship Building & Dry Dock Co. and her name will be changed to Minnesota.

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THE MARINE REVIEW

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From a Clear Sky

Among the many wonders of modern achievement the handling of iron ore at the lower lake ports takes high rank. The trade, to begin with, is not very old. Shipments began scarcely more than 50 years ago. Its great development, however, has been a matter of the past few years. More ore was brought down the great lakes last year than was moved in the first 30 years of the trade's existence altogether. Obviously the handling of a business of such remarkable growth has been no easy matter. No precedents existed as a guide and the whole problem had to be thought out on original and virgin lines. It has been a matter of continuous adjustment. New problems are constantly arising and must be solved right in the heat of the day's work. It is scarcely 10 years ago since every ore bucket on the great lakes was filled by hand. The advent of the self-filling bucket worked a revolution in the trade and meant the scrapping of machinery that had cost much money and the installation of new machinery that cost more. The railways owning the terminals have never hesitated to spend money to meet the new conditions. They have even discounted the future in their latest installations, exhibiting an abiding faith in the growth of the country.

And now for the first time they are accused of dishonest practices in the handling of this great commerce. Sweeping indictments charging rebating and conspiracy have been returned against the Pennsylvania railway, the Lake Shore railway, the Bessemer & Erie railway and the Nickel Plate railway, as well as against the Angeline Dock Co., the Union Dock Co., the Mahoning & Shenango Dock Co., the Ashtabula Dock Co. and the Pittsburg & Conneaut Dock Co., which leases the docks from the railways and operates them. In addition, personal indictments have been returned against D. R. Hanna and Robert L. Ireland, of the firm of M. A. Hanna & Co., and D. T. McCabe, vice president of the Pennsylvania railroad. M. A. Hanna & Co. operate the docks owned by the Pennsylvania railway at Lake Erie ports. Pickands, Mather & Co. operate the Lake Shore dock at Ashtabula under the name of the Ashtabula Dock Co. It is doubtful if two more reputable concerns exist in the United States than those of M. A. Hanna & Co. and Pickands, Mather & Co. The late Senator Hanna, who founded the firm of M. A. Hanna & Co., scarcely had his peer among his country's business men. His business prospered because it was founded upon principles that were sound and honest. His sense of personal honor was profound and his sense of public duty equally so. No man deserved villification less and yet no man got more; but those who knew him admired him for what he was. His influence still permeates the firm of M. A. Hanna & Co. It is one of the most honorable business houses in the United States and has handled with consummate skill a business which has had to meet new and untried problems almost daily. The commerce of the great lakes is erratic. It fluctuates within wide latitudes, even as much as 50 per cent in a single year. Such business requires constant readjustment of operating forces and operating charges.

About a year ago the Interstate Commerce Commission began an investigation into the problem of handling ore on the great lakes. Access to all records was given freely to the commission's agents and not a scrap of information was withheld. Now at this late day follow indictments charging the railroads and dock companies with rebating. It is difficult to understand how such charge could be made since such refunds as were made were horizontally applied to all shippers and were moreover definitely published in the tariff submitted to the Interstate Commerce Commission. Whether a shipper took a ton or a car load or a train load, he got exactly the same treatment.

A little over two years ago, however, it became apparent to the railroads that the installation of improved machinery was making it possible to handle the ore at docks at greatly reduced cost and the railroad company was naturally reluctant that the dock company should have the benefit of

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all the profit accruing. It was therefore suggested by the railroad company that after the dock company had won a reasonable profit from the business the surplus remaining should be refunded to the shippers. The amount of this refund could not be determined until after the season's business was ended and for that reason the rate for this extra allowance was not published in the tariff. This practice was followed until a definite and equitable adjustment could be determined upon when the charge to shippers was accordingly reduced and the practice of making this extra refund abolished. If any violation of the law existed in this particular feature it was simply a technical violation. There was no discrimination against any shipper or any intention to discriminate. All were treated alike and as soon as costs could be brought under the new and improved conditions into an established order, the charge was reduced to meet them. Certainly every candid mind must approve of such a course.

The statements published elsewhere in this issue by Messrs. L. C. Hanna, Samuel Mather and D. T. McCabe are very clear and convincing; but death loves a shining mark, they say, and likewise does the political agitator.

Supplies for Panama

Congressman E. A. Hayes of California introduced in the house of representatives on April 13 a resolution providing for the transportation by sea of all material and equipment for use in the construction or maintenance of the Panama canal in vessels of United States register exclusively. It is hoped that congress will have the good sense to adopt this resolution and thereby conserve to the American ship a trade that rightly belongs to it. The American people are bearing the whole cost of constructing the Panama canal and therefore its citizens are entitled to any profit accruing from its construction. It should have been definitely provided in the beginning that material to be used in its construction should be transported there in American ships. The canal zone is virtually American territory and ought to be regarded as coastwise trade. As it is everything about the enterprise is protected except the ship. The great political party pledged to the policy of protection has never done anything for the American ship. It would be a timely and well deserved rebuke if the party should now perform this very service.

A Noteworthy Performance

An improvement of over 30 per cent in the average speed of a ship is worthy of note, but when accompanied by a fuel reduction of nearly 50 per cent, is so strikingly unusual as to merit attention. Reports from Buffalo indicate that these results have been attained with the steamer Tioga, which, as previously noted in THE MARINE REVIEW, with the other ships of the Union Steamboat Line (Erie railroad), was last winter placed in the hands of Babcock & Penton, engineers and naval architects, Cleveland and New York, to be overhauled and improved.

The Tioga was the first of the fleet to be taken in hand and underwent extensive alterations during the winter and her performance since going into service has aroused keen interest and widespread comment.

The architects decline for the present to give out any details of the changes instituted or to make any comment upon the reports except to say that they do not overstate the facts and that the best results have not yet been reached.

It has been learned, however, that while the old boilers were retained, the installation was entirely rearranged and a positive heated draught system, with certain new features, fitted; the old cylinders, air pumps, condensers and propeller were discarded and new parts designed and fitted besides much other work.

It is stated that the actual reduction in fuel is over 130 tons per round trip between Buffalo, Milwaukee and Chicago, and the increase in speed nearly three miles per hour. It follows, of course, that a substantial gain is also made in cargo capacity and the increase in speed will, it is claimed, add two full trips per season. The other ships of the fleet will be taken in hand as opportunity offers.

Ore on Dock May 1

Statistics gathered by THE MARINE REVIEW from the various dock managers at Lake Erie ports show that the amount of ore on Lake Erie docks May 1 of the present year was 7,654,620 tons as against 5,444,080 tons in 1910, an increase of 2,210,540 tons. These figures include April receipts at Lake Erie ports.

The total rail shipments from Lake Erie ports to furnaces during the winter season (Dec. 1 to May 1), aggregated 1,772,261 tons, viz.:

On dock Lake Erie ports, Dec. 1, 1910	9,426,881
On dock May 1, 1911	7,654,620
By rail to furnaces, winter of 1910-11	1,772,261

Adding these winter shipments to 30,060,096 tons, the amount shipped to furnaces during the navigation season of 1910, gives 31,832,357 tons as the entire consumption of ore from Lake Erie ports during the year ended May 1, 1911, as against 33,599,013 tons for the year ended May 1, 1910; as against 20,524,523 tons for the year ended May 1, 1909; as against 31,692,446 tons for the year ended May 1, 1908; as against 30,099,769 tons for the year ended May 1, 1907; as against 28,984,358 tons for the year ended May 1, 1906; 20,057,070 tons for the year ended May 1, 1905; 18,739,995 tons for the year ended May 1, 1904; 21,905,251 tons for the year ended May 1, 1903; 17,216,065 tons for the year ended May 1, 1902; 14,465,260 tons for the year ended May 1, 1901; 15,882,881 tons for the year ended May 1, 1900; 12,122,982 tons for the year ended May 1, 1899, and 10,209,488 tons for the year ended May 1, 1898.

The following table gives the amount of ore on dock at the close of navigation last year and the opening this year:

Ports.	May 1. 1911.	Dec. 1. 1910.
Toledo	383,761	433,215
Sandusky	11,458	17,728
Huron	273,042	375,118
Lorain	1,151,184	259,448
Cleveland	1,502,858	1,638,795
Fairport	633,485	839,970
Ashtabula	2,277,931	3,287,816
Conneaut	419,421	1,329,997
Erie	653,778	792,011
Buffalo	347,702	452,783
	7,654,620	9,426,881

April Ore Shipments

Ore shipments during April were 331,645 tons, as against 1,520,305 tons shipped during April, 1910, a decrease of 1,188,660 tons. It will be recalled that the season of 1910 opened with a rush to the great regret of vessel owners who were forced to retire a fair portion of their vessels within two months thereafter. Shipments by ports were:

Port.	April, 1910.	April, 1911.
Escanaba	223,025	93,532
Marquette	135,559	14,838
Ashland	218,703	41,337
Superior	355,307	76,739
Duluth	309,427	51,042
Two Harbors	278,284	54,157
	1,520,305	331,645
1911 decrease		1,188,660

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Lake Marine Savings Bank

AFTER a great deal of thought a simple savings bank system has been devised whereby the sailors aboard lake vessels may deposit their savings at 4 per cent interest without leaving the ship and yet have immediate access to their deposits at all times. The system has been devised by the Cleveland Trust Co. and meets with the hearty approval of the Lake Carriers' Association which, through its welfare committee, has for a long time cast about for some plan whereby those aboard ship might have the same banking facilities as those ashore. The Cleveland Trust Co. decided to organize a lake marine savings department and the plan devised is certainly very simple and safe. It is expected that the men will wish to deposit money only as they are paid off. The master will ask each man as he pays him if he wishes to deposit any part of his pay in the bank. If so, instead of paying that part in cash the master will make a draft on the owner for deposit to the credit of the sailor. The trust company has provided blanks for that purpose. The upper part of the blank for depositing money contains the blank draft on the owner. The lower part provides instructions as to the disposition of the savings pass book. The blank is to be carboned in triplicate—original to be mailed to the bank, which will collect the draft from the owner and credit to the depositor; duplicate to be mailed to the owner as his advice of the draft on him; triplicate to be retained by the master as his record of the transaction.

The withdrawal blank is even simpler. It is an order on depositor's bank account. The bank will honor it by mailing to the address indicated a New York draft to the order of the depositor. In cashing the draft at any port the depositor can be identified by the master or otherwise, or the master himself may cash it if he has the funds.

The Cleveland Trust Co. has gone to considerable expense to provide the necessary blanks and stationery for each boat. President Livingstone, of the Lake Carriers' Association, has sent to every vessel manager in the association application blanks for necessary stationery to be sent to the Cleveland Trust Co. Applications have already been filed for about 230 vessels enrolled in the association.

The general plan can better be understood by reproduction of the blanks for depositing money and for withdrawing it. The instructions given for depositing money are clear, as follows:

Fill in each of the following spaces with the appropriate information:

Name of steamer;

Port and date;

Amount in words and figures—never in excess of the pay due;

Depositor's name;

Depositor's rating;

Trip number;

Master's signature.

The lower half is information for the bank. Fill out as follows in the appropriate spaces:

Name of person to whom receipt or pass-book is to be mailed;

Address to which receipt or pass-book is to be mailed;

Cross such squares as will complete the directions;

(MAIL TO THE CLEVELAND TRUST CO CLEVELAND, OHIO)

The Cleveland Trust Company SAVINGS BANK

LAKE MARINE SAVINGS DEPARTMENT

STEAMER _____

PORT OF _____ DATE _____ 191__

PAY TO THE ORDER OF

The Cleveland Trust Company NO. ____

_____ (Write amount in words) DOLLARS $ _____ (Amount in figures)

AND CHARGE ACCOUNT OF _____ (Print depositor's name)

RATING _____ (Write in depositor's occupation) TRIP No. _____

TO THE PITTSBURGH STEAMSHIP CO. CLEVELAND, OHIO

SIGNED _____ MASTER

Master will fill out as directed below

RECEIPT OR PASS BOOK TO BE MAILED TO

_____ (Print out name of person to whom receipt or pass book is to be mailed)

_____ (Print out address where receipt or pass book is to be mailed)

(Put a cross [X] in square opposite directions desired)

- ☐ He already has an account with The Cleveland Trust Co.
- ☐ He has no account but wishes to open one.
- ☐ Savings Pass Book is enclosed herewith
- ☐ Please hold Pass Book for him at the bank.
- ☐ Please return Pass Book to above address.

Master must fill out

STEAMER _____

PORT OF _____

DATE _____ 191__ NO. _____

$ _____

ACCOUNT OF _____

RATING _____

TRIP No _____

_____ MASTER

BE SURE TO HAVE THE DEPOSITOR SIGN HIS OWN NAME BELOW

The Cleveland Trust Company:

THE ABOVE AMOUNT IS TO BE DEPOSITED TO MY CREDIT IN ACCORDANCE WITH YOUR RULES GOVERNING SAVINGS ACCOUNTS

_____ Depositor's permanent address

_____ Depositor's signature

FORM OF DEPOSIT BLANK.

The Cleveland Trust Company SAVINGS BANK

LAKE MARINE SAVINGS DEPARTMENT

SAVINGS WITHDRAWAL ORDER

Steamer _____

Date _____ 191__

To The Cleveland Trust Co.
Cleveland, Ohio

PLEASE MAIL A NEW YORK DRAFT FOR $_____ TO THE ADDRESS GIVEN BELOW AND CHARGE THAT AMOUNT TO MY SAVINGS ACCOUNT, NUMBER _____

_____ Depositor's Signature

MAKE DRAFT PAYABLE TO

_____

_____ Address to which draft should be mailed

PASS BOOK MUST ACCOMPANY THIS ORDER UNLESS LEFT ON FILE AT The Cleveland Trust Company

DON'T FAIL TO GIVE THE FOLLOWING INFORMATION

Put a cross X in square opposite directions desired

- ☐ Pass book is left on file in
- ☐ Pass book is enclosed herein
- ☐ Return pass book with draft to above address
- ☐ Send pass book to _____

SAVINGS WITHDRAWAL ORDER.

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Have the depositor sign his name on the line in the right-hand lower corner;

Write the depositor's permanent address (his home when ashore) in the lower left-hand corner.

The information in the column headed "Master need not fill out" will be entered by the bank.

Having filled out the form as directed, you will have three copies. The first copy (colored paper) is to be detached at the perforated line and mailed to The Cleveland Trust Co., in one of the envelopes addressed to that bank. The tissue remains in the pad, as the master's record of the transaction. The third form (heavier white paper) is to be detached and mailed in one of the envelopes addressed to the owner, in order to notify the owner of the draft you have made on him.

If you spoil a sheet, destroy the original; mark the tissue "void," and leave it in the book; mark the heavier white paper "void," and mail it to the owner. Write the word "void" large across the written lines of the sheet.

Don't forget that when you have mailed the colored paper form (the original draft) to the bank, you have in effect paid the depositor the amount of money it calls for. That amount should, of course, be deducted from his pay, for the owner will have to pay the draft and charge it against the man's pay for the trip.

When you cross the squares at the left of the blank, remember that it will be more convenient for you and for the depositor to leave the pass book at the bank. Many people do this as a matter of convenience. In such cases the bank mails a receipt which is just as good as the pass-book; but it will be glad to mail the pass-book if that is what is desired. It makes no difference to the bank.

Accounts can be opened with any amount from $1 upward.

The instructions for withdrawing money are also very clear, as follows:

The blank must be filled out and signed by the depositor, or filled out by the master and signed by the depositor, and mailed to the lake marine savings department of the Cleveland Trust Co. in one of the addressed envelopes. The pass book must be returned in the same envelope unless it has been left at the bank. Be careful about instructing the bank where to send the money. The bank will mail a New York draft to the address given. When the draft is received it can be cashed anywhere the depositor is known or by the master himself. After the close of navigation the depositor can draw on his bank account any time just by writing the bank a letter stating how much he wants and enclosing his bank book. If the book has been left at the bank all the depositor has to do is to write the letter.

Lake Situation

Navigation opened on the great lakes officially on April 15 though few steamers took advantage of it. The number of boats in commission on May 1 was small in comparison to the number usually in commission at that time of the year. The outlook is not promising and less money will be made all around except that labor will in no sense be disturbed. Ore prices have been fixed at 50 cents per ton less than 1910 prices. In other words the price of ore is now the same as it was in 1909. The freight has also been cut 10 cents a ton, being 60 cents from the head of the lakes, 55 cents from Marquette and 45 cents from Escanaba. These rates are in effect the same as prevailed in 1908 and 1909, as the unloading charge to the vessel was reduced 5 cents during 1910 and this reduced charge of course still obtains. The coal rates are the same as last year, 30 cents to the head of the lakes and 35 cents to Lake Michigan. On the other hand underwriters have reduced insurance rates from 6 per cent to 5¼ per cent, the policy to expire with the season of navigation. This concession, though small, is nevertheless recognition of the efforts which the Great Lakes Protective Association is making to minimize the number of accidents on the great lakes.

No season on the great lakes has opened more tamely than the present one. Independent owners are quite reluctant to put their vessels in commission and many of them have declined to take coal for immediate delivery. In fact, such as have put the coal aboard have reserved the right to delay delivery if necessary until June. The Pittsburg Steamship Co. is practically the only company that has put all of its vessels into commission. Some of the leading shippers owning tonnage have not as yet made sufficient sales to justify sending their boats out, while other furnace interests owning vessels have decided to charter rather than to put their small or ships in commission. Moreover, stages of water are quite low and the larger class of carriers will not carry as much as they did last year. It is idle to predict how long this state of things will continue. The iron trade has always been subject to most violent changes and it is impossible to predict with any certainty what it will be a few months hence.

April Commerce Sault Canal

The report of the superintendent of St. Mary's Falls canal shows that 792,587 net tons of freight passed through them during April, 1911, as against 1,958,913 tons during April, 1910, a decrease of 1,266,326 tons. The Canadian canal bore the greater part of the commerce, carrying 610,851 tons as against 181,725 tons for the American canal. The Canadian canal opened April 22 and the Poe lock April 24. The summary is as follows:

East Bound.

Copper, net tons	4,844
Grain, bushels	1,280,474
Flour, barrels	244,070
Iron ore, net tons	136,315
Lumber, M. ft. B. M.	3,328
Wheat, bushels	5,664,653
General merchandise, net tons	2,433
Passengers	255

West Bound.

Coal, hard, net tons	52,943
Coal, soft, net tons	280,468
Flour, barrels	125
Manufactured iron	19,137
Salt	26,907
General merchandise, net tons	59,721
Passengers	495

Summary.

Vessel passages, number	374
Registered tonnage net	608,795
Freight, east bound, net tons	370,325
Freight, west bound, net tons	422,262
Total freight	792,587

Personal

W. L. Andrews has opened an office at 506 Fisher building, Chicago, as marine surveyor and consulting ship builder. Mr. Andrews has spent practically all his life on the lakes and his experience in ship yard work has been quite extended. He began as an apprentice in the yard of the Detroit Dry Dock Co. under Frank E. Kirby in 1882 and remained there until the Cleveland Ship Building Co. was formed by J. F. Coffinberry and Robert Wallace, upon their retirement from the Globe Iron Works. He worked at the Cleveland yard until the Lorain yard was established, when he went there as assistant superintendent. He resigned later to become general superintendent of the plant of the Jenks Ship Building Co. at Port Huron, and was there continuously while the plant was engaged in steel ship building. After that he accepted the assistant superintendency of the Chicago Ship Building Co.'s yard at South Chicago. Of late he has been working in his own behalf, his most recent performance being the salving of the cargo of lumber of the schooner Ottawa, wrecked off Clayhark, Wis.

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Death of Alexander E. Brown

Alexander E. Brown, president of the Brown Hoisting Machinery Co., died at his home in Cleveland, on April 26, from a stroke of apoplexy, having suffered two shocks during the past year. He was born in Cleveland in 1852, the son of Fayette Brown, who about that time or a little later began to pay some attention to the development of the iron resources of the Lake Superior country. It was therefore quite natural that Alexander E. Brown as he grew to manhood should be attracted to the mechanical problems involved in the handling of ore. He attended the Brooklyn Polytechnic Institute, specializing in mechanical and civil engineering. He joined the Hayden geological

ALEX. E. BROWN

survey in 1872 and upon his return from the west became connected with the Massillon Bridge Co., Massillon, O. He later associated himself with his father and attacked the problem of ore handling on the great lakes. The ore trade, now one of the largest single trades in the world, was at that time just beginning to expand, and the problem of getting the ore out of the vessel was a vexatious one. Mr. Brown invented a machine which served the combined purpose of hoisting and conveying to storage, greatly lessening the time of unloading. At one time the Brownhoists were handling 90 per cent of the ore on the lakes. The business grew rapidly and Brownhoists were installed in all countries for the handling of bulk material.

Mr. Brown was a member of the American Society of Mining Engineers, the Engineers' Club of New York, the Cleveland Society of Civil Engineers and the Union and Country clubs.

In 1874, Mr. Brown married Miss Caroline Barnett, daughter of the late Gen. James Barnett. He is survived by a daughter, a son, Alexander C. Brown, two sisters, Florence C. and Mary L. Brown, and one brother, Harvey H. Brown.

Blue Book of American Shipping

THE MARINE REVIEW is now prepared to deliver the 1911-12 edition of the Blue Book of American Shipping, the standard marine directory of the United States. Lists are published of the leading vessel owners of the coasts and western rivers, together with the tonnage owned by them. This list of coastwise vessels is not complete, as there are many difficulties in the way of making such a list complete, but it is believed to be accurate. Full particulars are given of the lake fleet, together with names and addresses of owners, embracing not only American but Canadian tonnage as well. Lists are published of the ship and engine builders of the coasts, western rivers and great lakes; the dry docks and marine railways of the coasts, rivers and lakes, and the builders of power and pleasure boats. All the societies having to do with marine trade are also included, such as the Society of Naval Architects and Marine Engineers, the New York Maritime Association, Philadelphia Maritime Exchange, the American Steamship Association, the Atlantic Carriers' Association and the National Board of Steam Navigation. The directory of domestic and foreign steamship lines is also complete. The statistics of lake commerce have also been retained and greatly amplified.

The price of the Blue Book is $5 and is delivered anywhere in the world carriage free. Orders should be addressed to the Book Department, Penton Publishing Co., Cleveland, O.

Fisher-Clement Collision

The new steel steamer E. L. Fisher was sunk in collision with the steamer S. M. Clement in the Detroit river, on Thursday, May 4, three members of her crew being drowned. The Fisher was struck immediately abaft the forward quarters on the port side and was practically thrown on her beam's end, sinking within three minutes. Particulars as to the cause of the accident are not as yet available. The Fisher, which was owned by the Argo Steamship Co., of Cleveland, has been abandoned to the underwriters as a constructive total loss. Contract has been awarded to the Great Lakes Towing Co., upon its bid of $39,000 or 40 per cent of the salvage value, underwriter's option, for raising her. It will be a difficult job to raise the Fisher, as she lies in 35 ft. of water and is deeply imbedded in the mud. The Clement is owned by the Buffalo Steamship Co., Buffalo, and is managed by Capt. John Mitchell of Cleveland.

The Iron Ores of Lake Superior

Crowell & Murray, chemists and metallurgists, Perry-Payne building, Cleveland, have just published a book entitled "The Iron Ores of Lake Superior." While much of the information contained in this work has appeared in the transactions of scientific societies, trade journals and the reports of the geographical survey, this is the first time that it has been brought together in such convenient form. A brief history is given of the iron mining country together with its geological formation. Then follows a brief description of the various ranges. Descriptions and composition are also given of the various ores, such as hematite, limotite, magnetite, turgite and martite. The methods of mining are also touched upon, as well as the classification and sampling of the ores.

The prime value of the book, however, lies in the fact that it gives the complete history of every mine in the Lake Superior country, giving the character of the ore, its cargo analysis, its shipments year by year and its method of mining, together with the railway serving it and the dock over which it ships, as well as the names and addresses of operators and sales agents. Maps and charts are also published of the various ranges, the loading docks and unloading machinery. The price of this book is $3.50 and orders should be addressed to the Book Department, Penton Publishing Co., Cleveland, O.

The names of the steamers S. C. Reynolds and George J. Gould of the Union Steamboat Line (Erie Railroad) have been changed to the John G. McCullough and Granville A. Richardson respectively.

Masters of lake vessels are advised to look at page 342 of the new directory of the Ship Masters' Association for 1911, where they will find something of great interest to them.

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Charged with Rebating

THE federal grand jury at Cleveland has found 13 indictments for rebating and conspiracy against four railroads and three individuals as follows:

For conspiracy, Dan R. Hanna, Robert L. Ireland, D. T. McCabe, vice president Pennsylvania Railroad.

Lake Shore & Michigan Southern Railway Co., five counts; conspiracy with Angeline Dock Co., Union Dock Co., Mahoning & Shenango Dock Co., Ashtabula Dock Co., Pittsburg & Conneaut Dock Co.

For rebating, Pennsylvania Railway Co., 35 counts; Lake Shore & Michigan Southern Railway Co., 32 counts; Bessemer & Lake Erie Railway Co., 28 counts; Nickel Plate railway, six counts.

The docks, while owned by the railways, are leased to operators, M. A. Hanna & Co., handling the Pennsylvania docks and Pickands, Mather & Co., the Lake Shore. Five dock companies altogether are involved, including those operated for the United States Steel Corporation and the Jones & Laughlin Steel Co. Specifically the charge is that the railways have rebated a portion of the freight rate to the dock companies and that the dock companies have in turn rebated a part of it to the shippers.

The practice complained of no longer obtains. The present inquiry is technical in character, involving construction of the law as to what rebating is. Both railways and dock companies contend that the transactions mentioned in the indictment were in no sense rebates but were rather an adjustment of earnings to give the shippers the benefit of decreased costs due to the installation of improved machinery.

D. T. McCabe, fourth vice president of the Pennsylvania railroad, Dan R. Hanna and R. L. Ireland, indicted for conspiracy, appeared in the federal court and furnished bond in the sum of $5,000 each for their trial on the criminal charge.

Interview With L. C. Hanna.

Leonard C. Hanna, brother of the late Senator Hanna, and uncle of Dan R. Hanna, when questioned by *The Iron Trade Review* concerning the recent indictments, said:

"I was identified with the operation of the docks at Ashtabula from 1875 to 1905, and, during the last several years of my active connection with the business, was connected with all the Penna docks at Cleveland, Ashtabula and Erie. During that period of time there were, of course, many changes, not only in the physical operation by reason of improved machinery and the large increase in tonnage, but also in the dockage allowance per ton of ore. Of recent years the Pennsylvania Co. has paid to all furnaces and consumers of ore shipping ore over its docks and railroad a fixed sum per ton, which has always been named in its tariffs. These allowances represented the profit accruing from the amount allowed by the railroad company to the dock company for handling, and in all of these years all shippers have received the same allowance per ton, and the best evidence of its satisfaction to the consumers was the fact that during my active connection with the business I do not recall one single complaint or an intimation that there was any discrimination."

"I notice in all accounts given by the newspapers these allowances are referred to as rebates," was suggested.

"I cannot see why they should either be so called or considered, in the usual use or acceptance of that term. These allowances were published in the tariff issued by the Pennsylvania Co., and were in the case of every shipper, whether it be one car-load or ten thousand car-loads, paid alike. The distribution of these allowances was made through the firm or dock company as lessees or contractors for the railroad, and I know there was no discrimination. I am not now connected with the firm, but I am and have been, since I retired, in close touch with its business and know the business is conducted along the same lines as it has been for many years."

"Mr. Hanna, the papers appear to attach importance to some special allowance. Do you know anything regarding this?"

"Yes, I know that a special allowance was paid publicly to all consumers. This was a surplus created from the unloading charge paid by the vessels owing to the improved unloading machinery, and not by any money paid by the railroad company, and I also know that there was no discrimination, and that every consumer received his proper proportion of the surplus regardless of whether he was a small shipper or a large shipper.

"If there is any basis for action brought against the firm I believe it must be technical in character. But this I assume will all be brought out if the case is carried into the courts. The impression created is that the firm and railroad company have intentionally been guilty of wrong-doing. This I know is not so, and it is not fair that the public should so understand.

"I have no direct interest, but naturally I have a pride in the reputation of a firm that my brother, Mark Hanna, was the senior member of for 38 years, and of which I was a member for 30 years."

President McCrea's Statement.

The following statement is made by James McCrea, president of the Pennsylvania Railroad:

The action of the grand jury, so far as I understand it, is based on the following condition of affairs: During the year 1908, and a portion of the year 1909, iron ore was landed from vessels at docks on Lake Erie belonging to the Pennsylvania Co., which docks were being operated by M. A. Hanna & Co. as a dock company, with whom an agreement was entered into for handling ore from the vessels to the cars and docks of the railroad company. The vessels paid a fixed price per ton for unloading, and the railroad company a fixed price per ton for loading the ore on the cars, the prices thus established being the current prices at practically all of the docks of all railroads at Lake Erie ports.

Owing to the introduction of improved ore-handling machinery during this period, the cost of handling the ore was found to be less than the sum of the payments made to the dock companies by the vessels and the railroad companies, but the exact amount of this possible saving could not be determined until the close of the season. It was therefore provided in the agreement that after deducting from the gross receipts of the dock company, rental, cost of operation and maintenance, and proper remuneration for services rendered, that portion of the saving per ton published in the tariffs of the railroad company, filed with the Interstate Commerce Commission, was to be paid currently by the dock company to the consumers of ore, and any additional surplus or saving that might possibly remain at the close of the year should also be apportioned among the consumers of ore in the proportion that the ore received by them over the Pennsylvania company's lines and connections bore to the total ore tonnage forwarded from the Pennsylvania company's docks. This, of course, absolutely insured uniform rates to all consumers of ore forwarding from those docks.

The tariffs duly published and filed with the Interstate Commerce Commission showed clearly the current payments to be made by the dock company to all these consumers of ore, but appear to have been silent as to the final distribution to be made by the dock company of any possible additional saving; consequently, if in the company's effort to carry out the exact spirit of the law and insure im-

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partial treatment to its patrons, the failure to note in the published tariffs the provision for the final distribution of the possible additional saving (of which every consumer had not only knowledge but notice) was not strictly in accordance with the law, the violation was only technical and wholly unintentional.

There can be no question of discrimination involved, as all consumers, both large and small, were treated with strict impartiality; there never was nor could be any favoritism, for the rate to each one was exactly the same.

The indictment of Mr. Hanna, president of the dock company, and of Mr. McCabe, vice-president of the railroad company, for alleged conspiracy, appears to be due solely to the fact that it was they who executed, on behalf of their respective companies, this contract by which exact and absolute equality of rates to all consumers of ore forwarded from Pennsylvania company's docks was guaranteed.

Mr. Mather's Statement.

Mr. Mather's statement is as follows:

I have read the statements of President McCrea and Mr. L. C. Hanna with regard to the so-called dock company rebates and wish to endorse all they say as being absolutely in accordance with the facts.

Our firm of Pickands, Mather & Co. also has been managing and operating ore docks at several lake ports through dock companies under arrangements practically similar to those of the Hanna dock companies, except that our dock companies make no allowances other than those published in the railroad tariff, dividing any surplus among stockholders.

But as President McCrea and Mr. Hanna so clearly state, their further distributions are notably to all companies receiving ore over these docks, and without discrimination, and were not published beforehand for the reason that it was impossible to determine beforehand what such surplus might be from year to year.

Their allowances or distributions are, if anything, therefore, even more equitable than those of other dock companies, and certainly if they or we have been guilty of violating the law in any respect this is the first suspicion or intimation any of us has ever had of it.

There has been absolutely nothing underhanded in it—everything has been known by all parties concerned—the tariffs have been filed with the Interstate Commerce Commission; and if there has been any violation of the law on the part of any one of us, I am sure it can be but a technical and unconscious one at the worst.

Details of Indictments.

The indictment for conspiracy returned against Dan R. Hanna, Robert L. Ireland and D. T. McCabe, charges that on Jan. 25, 1909, the M. A. Hanna Co. leased from the Pennsylvania company docks 1, 2, 3 and 6 at Cleveland; docks 2, 3 and 5 at Ashtabula, and docks 1 and 4 at Erie, for a five-year period, the lease to continue from year to year after that time.

The power house at Ashtabula also was included in the lease, the annual rental being $154,662. These docks were equipped with ore handling machinery and the Hanna company agreed to organize a dock company to operate them and handle ore from the vessel to the pile or car at the rates agreed on. It is specifically agreed that all ore unloaded on these docks shall be reloaded in cars for the Pennsylvania lines and the compensation is set down at 20 cents per ton, that price to be reduced if the prevailing rates go lower. The copy of the contract as set out in the indictment then states:

Consumers whose blast furnaces are on the Pennsylvania lines, east or west of Pittsburg, whose shipments of ore pass over the docks of the Pennsylvania at Cleveland, Ashtabula and Erie shall be given an opportunity in an agreement to be formally entered into between the Hanna company and the consumer to share in profits of the said dock company on the basis of business handled by them over the docks.

Further along in the copy of the alleged contract is this statement:

And provided dock refunds are continued to consumers of ore by other dock companies.

The copy contains the statement that the dock company shall pay the cost of securing business, and operating the docks, "and also current payments to consumers of ore," then the remaining surplus shall be divided at the end of the dock year, which is March 31, proportionately on the ore shipped over the docks.

The indictment also sets forth an agreement between the Hanna company and Cambria Steel Co. for ore to be handled over the Ohio & Western Pennsylvania docks at Ashtabula and Erie for five years and provides for a refund of 12 cents per ton on the ore handled. It also states that, as the Cambria Steel Co. had handled an average of 1,190,428 tons per year over the docks for a period of three years past, it was to be entitled to that portion of the profits from the dock company, which was figured as being 17¼ per cent.

It also charges the Ohio & Western Pennsylvania Dock Co. with paying on April 29, 1909, to the Midland Steel Co. a refund of $9,311.10, and with paying to the Carnegie Steel Co., of April 1, 1909, the sum of $50,111.93.

Another payment of $27,920.19 to the Carnegie Steel Co. is alleged to have been made by the dock company on Oct. 7, 1909. On the same date it is alleged the dock company paid to the Jones & Laughlin Steel Co. the sum of $8,693.90.

The Bessemer & Lake Erie road is charged with conspiracy in connection with the business of the Pittsburg & Conneaut Dock Co. The indictment says that on May 31, 1908, the Carnegie Steel Co. received a check for $4,530.79 from the dock company, as "dockage allowance" for May.

The Lake Shore road is charged with conspiracy with the same dock company, and it is charged the dock company paid to the Carnegie Steel Co. July 31, 1909, the sum of $35,505.31 as "dockage allowance."

The Lake Shore also is indicted for conspiracy with the Ashtabula Dock Co., and it is charged the Ashtabula Dock Co. paid to the Youngstown Sheet & Tube Co. in September, 1908, for "dockage allowance" the sum of $3,791.27.

The indictment against the Pennsylvania railway contains 35 counts and sets forth the charge that rebates were paid to the following steel concerns: Jones & Laughlin Steel Co., American Steel & Wire Co., Midland Steel Co., Republic Iron & Steel Co., Shenango Furnace Co., Carnegie Steel Co., United Iron & Steel Co., Stewart Iron Co., Cambria Steel Co., L. & R. Wistar & Co., National Tube Co., Norton Iron Works, Wheeling Iron & Steel Co., Ashland Iron Co.

Ventura Fans

For about four years, the American Blower Co., Detroit, Mich., have been developing a new curved blade disc fan, and have obtained some wonderfully high mechanical efficiencies, besides retaining every quality that should make the fan attractive to users, motor manufacturers or dealers. This new fan is called the Ventura. It has ten broad blades of the proper dip or curve to produce large volumes freely or against pressures and so efficiently that the power consumption is away below the usual. Patents on the constructional features have been applied for.

The Ventura fan runs at speed as high as any other fan of the disc type, it not higher, has remarkable capacity to overcome resistances, and throws an air current straight ahead. In fact, the air, as it leaves the fan, has a tendency to bend inward for a considerable distance before it begins to expand. This is contrary to the action of any other disc fan on the market. To illustrate this feature—one of these fans can be set 16 in. away from a hole in a box and discharge more air on the other side of the opening than the fan itself

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handles, due to the siphon action of the air as it passes through the opening drawing in air along the face of the box.

Particular attention is called to the mechanical efficiency of Ventura fans, which run as high as 64 per cent, whereas the best of the other two types shows a maximum of 24⅝10 per cent and the other 23 per cent maximum.

Commerce of Lake Superior

IT has frequently been stated in the columns of THE MARINE REVIEW that there is no accurate measure of the port to port commerce of the great lakes, and, therefore, no way of determining the total commerce of the great chain of waters. However, it is fair to assume that more than half of the commerce of the lakes passes through the canals at Sault Ste. Marie, and it is fortunate indeed that records at this point are very reliably kept by the officials in charge of the United States and Canadian canals. Supt. Louis C. Sabin has just submitted to Col. C. McD. Townsend for transmission to the secretary of war the exhaustive report of canal commerce for 1910 that is known as the mile-ton report. The report shows that $38,710,904 was paid as carrying charges to vessels that moved 62,363,218 tons of freight through the canals in 1910, and that the total value of the freight was $654,010,844. The cost per ton per mile of moving this freight was 0.74 of a mill, as against 0.78 of a mill in 1909, 0.69 of a mill in 1908, 0.80 of a mill in 1907, 0.84 of a mill in 1906, 0.85 of a mill in 1905, 0.81 of a mill in 1904, 0.92 of a mill in 1903, and 0.89 of a mill in 1902.

The total freight traffic of 62,363,218 net tons for the season of 1910 when compared with the season of 1909, shows an increase of 8 per cent or 4,468,069 tons. All the items of freight show an increase when compared with the season of 1909 except wheat, grain other than wheat, manufactured and pig iron and salt. The total number of passengers was 66,933, an increase of 6,985. Vessel passages through both canals numbered 20,899, showing a gain of 1,695 or 9 per cent. The total lockages numbered 14,569, a gain of 998 or 7 per cent. The season of navigation continued for a period of eight months and four days, during which time the average monthly freight traffic was 7,667,609 net tons.

The traffic through the American canal was 42 per cent of the total freight and 50 per cent of the total number of passengers carried, the amounts being 25,927,661 tons of freight and 33,536 passengers. Compared with the season of 1909 there was a decrease of 4,204,713 tons of freight or 14 per cent, and an increase of 5,800 passengers or 21 per cent. The American canal opened May 5 and closed Dec. 14, 1910, making the length of its season 224 days.

The traffic through the Canadian canal was 58 per cent of the total freight and 50 per cent of the passengers carried, the amounts being 36,435,557 tons of freight and 33,397 passengers. Compared with the season of 1909, there was an increase of 8,672,782 tons of freight or 31 per cent, and 1,185 passengers or 4 per cent. The Canadian canal was opened April 12 and closed Dec. 15, 1910, making the length of its season 248 days.

Total freight carried, tons	62,363,218
Total tons net register	49,856,123
Total mile-tons	52,405,535,136
Total valuation placed on freight carried	$654,010,844
Total amount paid for freight carried	$38,710,904
Total number of registered vessels using canals	877
Total number of passages by unregistered crafts carrying freight.	398
Total valuation placed on registered vessels	$134,698,500
Total number of passengers transported	66,933
Average distance freight was carried, miles	840
Average cost per ton for freight transportation	$0.62
Average cost per mile per ton, mills	.74
Average value per ton of freight carried	$10.49
Time American canal was operated, days	224
Time Canadian canal was operated, days	248
Freight carried by—	
Registered vessels, tons	62,334,124
Unregistered vessels, tons	29,094
American vessels, per cent	94
Canadian vessels, per cent	6
Passengers carried by—	
American vessels, per cent	38
Canadian vessels, per cent	62
Average number of vessels passing per day—	
Through Poe lock	38
Through Weitzel lock	25
Through Canadian lock	32
Through Poe, Weitzel and Canadian locks	84

The number of registered vessels of 600 ft. and over in length, using the canal in trade to and from Lake Superior, was 6; of 500 to 600 ft. in length, 123; of 400 to 500 ft. in length, 162; of 300 to 400 ft. in length, 152; of 200 to 300 ft. in length, 234; of 100 to 200 ft. in length, 100; of 30 to 100 ft. in length, 12. The maximum freight traffic for a single day was on Aug. 26, 1907, when 487,649 tons passed through the canals on 121 vessels, having an aggregate registered tonnage of 287,385. Forty-four new vessels were put in commission for the Lake Superior trade in 1910. With the exception of six tugs and yachts, all were steamships for freight traffic. Eighteen of these new vesels are 500 ft. or more in length and carry from 10,000 to 13,048 net tons of freight in a single cargo on a draught of 18 ft. 11 in. The largest single cargo carried through the canals in 1910 consisted of 13,048 tons on the steamer W. B. Schiller. The greatest amount of freight carried was 309,339 tons, by the steamer H. H. Rogers. The greatest number of miles run was 43,663, by the steamer D. J. Morrell, and the greatest number of mile-tons was 257,030,218, by the steamer H. H. Rogers. The following table will prove interesting as showing the distribution to other lakes of freight bound eastward from Lake Superior and also the district from which freight bound to Lake Superior originated:

EASTBOUND.

From Lake Superior ports to—	
Lake Michigan ports	6,181,362
Lake Huron ports	1,586,893
Lake Erie ports	38,543,746
Lake Ontario ports	821,709
Total	47,133,709

WESTBOUND.

To Lake Superior from—	
Lake Michigan ports	188,854
Lake Huron ports	418,895
Lake Erie ports	14,229,305
Lake Ontario ports	392,455
Total	15,229,509

In connection with the foregoing table, there is also the following summary of relative values of the different commodities passing through the canals:

Coal (anthracite and bituminous)	6.33
Cereals (wheat, rye, oats, corn, barley, flax and flour)	23.84
Iron ore	25.32
Iron (manufactured and pig iron)	4.96
Copper (refined and concentrates)	5.03
Lumber	2.07
All other products	32.45
	100.00

The American canal records show that vessels necessarily spent 22,093 hours and 30 minutes in canal, or an average of 2 hours and 13 minutes, which includes time waiting for lockage and passage through locks and canal, the latter being 1 3/5 miles long. Other delays at canal, which included taking on supplies, waiting for daylight or favorable weather, amounted to 3,754 hours and 6 minutes. Delays to vessels due to operating railway swing bridge amounted to 8 hours and 7 minutes. Trains were delayed 25 hours and 43 minutes by passing boats temporarily preventing the closing of bridge. The aggregate time the railway swing bridge was swung across the canal amounted to 682 hours and 21 minutes, during which time 3,240 engines, 5,057 passenger cars and 26,451 freight cars crossed the bridge.

Appended to this report is a calculation of the commerce passing through

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the Detroit river. While there is no means of obtaining the actual statistics of freight actually carried through the Detroit river, the government engineers have succeeded in approximating it by calculating the proportion of freight tonnage to registered tonnage. Both the registered and freight tonnage of the Sault Ste. Marie canals are known, and as the vessels which traverse the Detroit river are the same ones that pass through St. Mary's Falls canal, it is comparatively simple to approximate freight tonnage of the Detroit river. The report of the Detroit river traffic is as follows:

The number and class of vessels and the number of vessel passages have been taken from the custom house records at Detroit, Windsor and Amherstburg; and from the marine postoffice records at Detroit.

The registered tonnage is taken from the American and Canadian "blue books."

The postmaster at Detroit has permitted the records of vessels passing Detroit to be copied from the marine postoffice books. The record of those stopping at Detroit was obtained from the collectors of customs at Detroit, Windsor and Amherstburg. The vessel passages and registered tonnage by months are as follows:

Month.	No. of vessels.	Registered tonnage.
January	19	3,909
February	14	2,656
March	148	34,652
April	1,786	2,309,690
May	4,314	8,374,891
June	4,500	8,654,724
July	5,224	9,110,588
August	5,191	8,780,608
September	4,641	8,222,632
October	4,143	7,498,231
November	3,165	5,227,255
December	493	601,446
Total	33,638	58,821,282

The number of vessels using Detroit river during 1910 was as follows:

Number of American vessels	1,043
Number of Canadian vessels	174
Number of steam vessels	960
Number of sail vessels	257
Total number of vessels	1,217

It is found from the custom house records that 3,648,524 short tons that used the Detroit river did not go through the St. Clair Flats canal, but either stopped at Detroit or turned around and went back down the river. The commerce of the canal is therefore less than that of the river by this amount; making this subtraction, the tonnage passing St. Clair Flats canal is found to be 55,172,758 tons.

In addition to the preceding results there are a number of quantities that from the nature of the data can be very closely estimated. For example, the actual freight, in tons, that is carried through the Detroit river can be closely estimated by comparison with the tonnage of St. Mary's Falls canal, where records of both net registered and actual freight are kept. During the season of 1910 the actual freight passing St. Mary's Falls canal was 25 per cent greater than the net registered tonnage. Since about two-thirds of the Detroit river tonnage is St. Mary's Falls canal tonnage, there is no error in assuming that the ratio for these two-thirds is the same for Detroit river as for St. Mary's Falls canal. The remaining third is mostly traffic to and from Lake Michigan ports. An inspection shows that there is approximately the same proportional number of loaded and light vessels on this route as on the Lake Superior route. There can be no large error in assuming that the ratio between registered and freight tonnage for this one-third is also the same as that for St. Mary's Falls canal. Therefore increasing the registered tonnage by 25 per cent, the estimated actual freight of Detroit river is 73,526,602 "short tons."*

The value of the freight passing St. Mary's Falls canal during the season of 1910 was found to be $10.49 per ton. Assuming this unit value for the Detroit river commerce, the total estimated value of the actual freight passing Detroit river during the season of 1910 would be $771,294,055.

In addition, there are two registered passenger ferries, and five registered railroad ferries that have not been included in the preceding tables, also there is a large number of unregistered power boats using the river. No complete record of these boats is kept; the exact number is not known. The inspector of hulls reports that he has issued pilot rules to more than 1,500 motor boats, and the collector of customs estimates the number at "1,500 and upwards."

The commerce passing the Detroit river has now been determined with great accuracy for nine consecutive years and is as follows:

Year.	No. of passages.	Net registered tons.	Freight tons, estimated.	Estimated value.
1902..	33,000	39,328,689	44,260,506	$440,834,640
1903..	33,113	37,453,796	46,817,245	471,917,830
1904..	29,472	33,049,984	42,792,326	453,598,656
1905..	35,599	45,912,622	55,508,360	522,888,751
1906..	35,128	50,673,897	63,808,571	662,971,053
1907..	34,149	53,959,769	71,226,895	697,311,302
1908..	27,883	40,628,850	54,086,750	614,425,480
1909..	32,296	54,668,846	67,789,369	732,803,079
1910..	33,638	58,821,282	73,526,602	771,294,055

The number of vessel passages has increased 1,342 over last year. The net registered tonnage has increased 4,152,436 tons. There were 859 steam vessels having a tonnage greater than 100 tons. Their average tonnage was 2,227 short tons—an increase of 65 tons over last year.

There were 235 sail vessels having a tonnage greater than 100 tons. Their average tonnage was 944 tons, an increase of 263 tons. The average registered tonnage of all vessels using Detroit river during the season of 1910 was 1,758 tons, an increase of 50 tons over last year.

*2,000 lbs.

GENERAL SUMMARY.

Net registered tons, Detroit river	58,821,282
Net registered tons, St. Clair Flats canal	55,172,758
Total number of vessels	1,217
American vessels	1,043
Canadian vessels	174
Steam vessels	960
Sail vessels	257
Total number of vessel passages	33,638
Average tonnage of all vessels	1,758
Estimated actual freight	73,526,602
Estimated value of freight	$771,294,055

Attachment for Striking Ship's Bell

The Chelsea Clock Co., 16 State street, Boston, have devised an automatic electric attachment by which the regular ship's bell forward is correctly struck from the Chelsea ship's bell clock. The attachment does not prevent the tongue of the bell being left free for use by hand, but merely governs the announcement of the time from the clock. The device can readily be attached to any Chelsea ship's bell clock. If there is electrical power on board it is very little trouble to divert a portion of it for bell striking, and even on sailing craft it is easy to equip the necessary apparatus with simple wiring batteries. The manufacturers will supply all information upon request.

Contract for Car Ferry

The Mackinaw Trasportation Co., operating the car ferries St. Ignace and St. Marie between Mackinaw City and St. Ignace, has awarded contract to the Toledo Ship Building Co. for a new steel car ferry to be ready for service by October next. The new car ferry will be 352 ft. long and 60 ft. wide and will have a capacity of twenty-five cars. She will be designed by Frank E. Kirby.

New Firm of Brokers

Messrs. C. L. Lundquist and John I. Evans have formed a partnership under the firm name of Lundquist & Evans, with offices at 838 Engineer's building, as customs and insurance brokers. They announce that they are prepared to meet requirements as shipper or receiver in export, import and domestic freights, custom house clearances, marine insurance and the financing of foreign invoices.

The first cargo of ore of the season was delivered at Cleveland by the steamer B. F. Berry on April 19. The Berry sailed from Escanaba. The first cargo from Lake Superior was delivered at Ashtabula by the steamer L. C. Hanna on April 25.

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April Lake Levels

The United States lake survey reports the stages of the great lakes for the month of April, 1911, as follows:

Lakes.	Feet above tide-water, New York.
Superior	600.61
Michigan-Huron	579.44
Erie	571.45
Ontario	245.44

Lake Superior is 0.08 foot lower than last month, 1.01 feet lower than a year ago, 1.33 feet below the average stage of April of the last 10 years, 1.64 feet below the high stage of April, 1905, and 0.17 foot below the low stage of April, 1880. It will probably rise 0.3 foot during May.

Lakes Michigan-Huron are 0.14 foot higher than last month, 0.80 foot lower than a year ago, 1.11 feet below the average stage of April of the last 10 years, 3.79 feet below the high stage of April, 1886, and 0.22 feet above the low stage of April, 1896. They will probably rise 0.3 foot during May.

Lake Erie is 0.48 foot higher than last month, 0.63 foot lower than a year ago, 0.86 foot below the average stage of April of the last 10 years, 2.34 feet below the high stage of April, 1884, and 0.19 foot above the low stage of April, 1895. It will probably rise 0.3 foot during May.

Lake Ontario is 0.48 foot higher than last month, 0.53 foot lower than a year ago, 0.94 foot lower than the average stage of April of the last 10 years, 2.99 feet below the high stage of April, 1886, and 0.57 foot above the low stage of April, 1895. It will probably rise 0.3 foot during May.

Vessel Register Shows Progress

About 250 vessels on the great lakes are now classed by the Vessel Register, 60 Wall street, New York, of which Alfred Smith, Rockefeller building, Cleveland, is the representative for the great lakes. This register classes, for fire insurance only, and was organized for the purpose of establishing a standard of fire equipment on ship board. Vessels which are equipped in accordance with the rules can secure minimum rates for fire insurance.

New York Nautical College

Through the efforts and kindness of a number of prominent New York yachtsmen the New York Nautical College has become a part of the educational work at the West Side Young Men's Christian Association, 318 West Fifty-seventh street, New York City. Capt. Howard Patterson, who founded the college in 1882, will remain as principal under west side management.

The Nautical College, the equipment of which is worth more than $25,000, was bought outright for the west side branch by the yachtmen—friends of the association.

Under Y. M. C. A. management the Nautical College will continue general instruction in navigation for merchant marine officers, yacht owners, and yacht sailing masters and mates. The college will also have departments in marine engineering and special training for U. S. coast survey, transport and light house officers and naval architecture and a navy "prep" school. Instruction will also be provided naval militia officers and will prepare candidates as cadets for the U. S. naval academy and for the U. S. revenue cutter service.

The Nautical College will be moved to the building at 40 West Sixty-sixth street, which was recently acquired by the west side branch. This building is now being re-constructed into a modern fireproof structure, three stories in front and four in the rear. Beside the Nautical College this building will house the Automobile, the Motor Boat and the Aeronautic School.

Trade Notes

The Lagonda Manufacturing Co., Springfield, O., has just put out a catalog describing the relative advantage of various types of boiler tube cleaners. This line includes several types of water-driven cleaner, also a full line of air and steam-driven cleaners, and a type of mechanical cleaner, which is suitable for driving by the Lagonda external air or steam motor, or belting to steam engines or electric motors. Besides boiler tube cleaners, other boiler room devices are briefly described, such as the Lagonda water strainer for removing impurities from boiler feed or condenser water, the automatic feeding device for removing scale from Stirling boilers without entering the drum, the Lagonda double action cut-off valve for automatically shutting off steam in case of break in the line, besides other devices, such as tube cutters and reseating machines.

The United States Indestructible Gasket Co., Hudson Terminal, 50 Church street, New York, are building a new plant in Brooklyn, N. Y., which will have a space for machines equal to 10 ft. wide and 500 ft. long.

SUMMARY OF NAVAL CONSTRUCTION.

Name of Vessel.	Building at.	Per cent of completion. 1911. Mar. 1.	Apr. 1.
BATTLESHIPS.			
Florida	Navy Yard, New York	90.4	91.4
Utah	New York S. B. Co.	96.6	97.5
Wyoming	Wm. Cramp & Sons	53.4	56.8
Arkansas	New York S. B. Co.	60.3	63.3
Texas	Newport News S. B. Co.	2.4	4.6
New York	Navy Yard, New York		0.0
TORPEDO BOAT DESTROYERS.			
Warrington	Wm. Cramp & Sons	90.6*	
Mayrant	Wm. Cramp & Sons	94.6	96.5
Monaghan	Newport News S. B. Co.	74.5	84.5
Trippe	Bath Iron Works	98.7°	
Walke	Fore River S. B. Co.	87.7	91.1
Ammen	New York S. B. Co.	89.4	95.5
Patterson	Wm. Cramp & Sons	65.8	72.8
Fanning	Newport News S. B. Co.	3.2	9.3
Jarvis	New York S. B. Co.	2.7	8.1
Henley	Fore River S. B. Co.	4.9	8.4
Beale	Wm. Cramp & Sons	3.9	6.8
Jouett	Bath Iron Works	6.5	11.8
Jenkins	Bath Iron Works	6.3	10.7
SUBMARINE TORPEDO BOATS.			
Carp	Union Iron Works	83.1	85.1
Barracuda	Union Iron Works	83.1	85.1
Pickerel	The Moran Co.	77.5	79.5
Skate	The Moran Co.	77.3	79.5
Skipjack	Fore River S. B. Co.	83.2	83.8
Sturgeon	Fore River S. B. Co.	78.9	82.6
Thrasher	Wm. Cramp & Sons	32.3	35.5
Tuna	Newport News S. B. Co.	57.6	59.6
Seal	Newport News S. B. Co.	84.3	85.4
Seawolf	Union Iron Works	11.6	19.4
Nautilus	Union Iron Works	11.6	19.1
Garfish	The Moran Co.	13.5	16.0
Turbot	Lake T. B. Co.		5.4
COLLIERS.			
Neptune	Maryland Steel Co.	80.7	86.5

*Warrington was delivered at navy yard, Philadelphia, March 17, 1911.
°Trippe was delivered at navy yard, Boston, March 21, 1911.

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